

Annual Groundwater Report

For Calendar Year 2017

Santa Clara Valley Water District

2017 Annual Groundwater Report

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Acknowledgements

PREPARED BY:

Bassam Kassab, P.E.
Senior Water Resources Specialist

UNDER THE DIRECTION OF:

Vanessa De La Piedra, P.E.
Unit Manager, Groundwater Management Unit

Garth Hall, P.E.
Deputy Chief Operating Officer, Water Utility Enterprise

CONTRIBUTORS:

Chanie Abuye
Randy Behrens
George Cook
Melissa Fajardo
Jesus Garcia
Victoria García
Ardy Ghoreishi
Simon Gutierrez
Jeannine Larabee
Yaping Liu
Roger Pierno
Xiaoyong Zhan

GRAPHICS:

Benjamin Apolo III
Emily Cheung
Sarah Khosla

BOARD OF DIRECTORS:

Richard P. Santos
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District 1

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District 2

Nai Hsueh
District 5

Tony Estremera
District 6

Gary Kremen
District 7

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EXECUTIVE SUMMARY

The Santa Clara Valley Water District (District) is the Groundwater Sustainability Agency (GSA) for the Santa Clara and Llagas subbasins[1] in Santa Clara County, which are sustainably managed due to the comprehensive programs described in the District's 2016 Groundwater Management Plan (GWMP).[2] This Annual Groundwater Report for Calendar Year (CY) 2017 describes groundwater use, levels, quality, storage, and land subsidence and presents the information on GWMP outcome measures using recent data. These measures, identified in the GWMP, are the basis to evaluate performance relative to District Board of Directors (Board) **Water Supply Objective 2.1.1: "Aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion."**

Groundwater provided 42% of the total water used in the county in 2017. After five consecutive years of drought, local groundwater levels and storage recovered to pre-drought levels due to proactive drought response and improved water supply conditions. To help sustain and protect groundwater supplies, in 2017 the District:

- Recharged groundwater with 96,300 acre-feet (AF) of local and imported surface water,
- Reduced groundwater demands by about 192,000 AF through treated and recycled water deliveries and water conservation programs (which collectively provide in-lieu groundwater recharge),
- Conducted extensive monitoring of water levels, groundwater quality, and land subsidence,
- Implemented the well ordinance program and other activities to minimize threats to groundwater quality, and
- Worked with basin stakeholders, land use agencies, and regulatory agencies to protect groundwater resources.

Table ES-1 shows data for key indicators in 2017 as compared to 2016 and prior periods. Groundwater levels and storage recovered significantly, with about 25,700 AF[3] added to groundwater storage in 2017 since recharge exceeded pumping. Groundwater levels were well above historical minima in regional index wells, and approached or exceeded previous historical highs at many wells around the county. Estimated end of 2017 total groundwater storage was about 338,900 AF, which falls in the "Normal" stage (Stage 1) of the District's Water Shortage Contingency Plan, indicating good water supply conditions.

Groundwater quality remained generally good; the median principal aquifer zone values for Total Dissolved Solids (TDS) were below 400 milligrams per liter (mg/L) for all groundwater management areas. Median nitrate values were well below the drinking water standard of 10 mg/L in the Santa Clara Plain (3.06 mg/L), but were higher in the Coyote Valley and Llagas Subbasin (7.2 and 5.2 mg/L, respectively). As described below, the District continues to work with regulatory and land use agency to address this ongoing groundwater protection challenge.

[1] California Department of Water Resources (DWR) Basins 2-9.02 and 3-3.01, respectively. The District further divides the Santa Clara Subbasin into two groundwater management areas: the Santa Clara Plain and the Coyote Valley.

[2] Santa Clara Valley Water District, Groundwater Management Plan, November 2016. This plan was submitted to DWR as an Alternative to a Groundwater Sustainability Plan in December 2016.

[3] Groundwater storage estimates presented in this report are as of May, 2018. Storage estimates are updated as additional data becomes available.

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North County Groundwater Summary

Groundwater use in the Santa Clara Plain (the northern Santa Clara Subbasin) was 69,700 AF in 2017, a 25% increase from 2016. However, this is below the GWMP long-term average of 92,000 AF due to continued lowered demands since the drought. Pumping locations and use remained relatively stable, with nearly all groundwater used for municipal and industrial (M&I) purposes. Groundwater levels recovered from the recent drought and were well above both historical lows and minimum water level thresholds established to protect against resumed land subsidence. Estimated groundwater storage at the end of 2017 was 302,400 AF, which was 18,200 AF higher than 2016.

North County groundwater continues to have very good quality generally; in CY 2017, 99% of water supply wells tested met all health-based drinking water standards (one domestic well had elevated nitrate). Public water systems must comply with drinking water standards, which may require treatment or blending prior to delivery.

South County Groundwater Summary

In CY 2017, groundwater pumping in the Coyote Valley (the southern Santa Clara Subbasin) and Llagas Subbasin was 12,300 AF and 41,100 AF, respectively. Pumping increased by 12% in the Coyote Valley and 1% in the Llagas Subbasin compared to 2016. The distribution of pumping for M&I, domestic, and agricultural uses showed increased M&I use in the Coyote Valley compared to 2016. Like the Santa Clara Subbasin, groundwater levels showed recovery to pre-drought conditions and were well above historical lows at regional index wells. Estimated groundwater storage in South County at the end of 2017 was 36,500 AF, which is 7,500 AF higher than 2016.

Groundwater quality in South County is generally good, with most water supply wells meeting drinking water standards. However, nitrate continues to be a significant groundwater protection challenge and was detected above the drinking water standard in about 30% of South County water supply wells tested in 2017. As described in the outcome measure summary below, the District continues to work to address this challenge.

Perchlorate contamination in the Llagas Subbasin from a former highway safety flare plant has been substantially reduced due to ongoing managed recharge by the District and active remediation by the responsible party. The perchlorate plume, which once extended from Tennant Avenue in Morgan Hill to Gilroy (about 10 miles), now extends from Morgan Hill to the San Martin Airport, shrinking about 7 miles. Cleanup continues to progress well, with six domestic wells requiring replacement water as of February, 2018. The District continues to monitor related activities and advocate for expedited and thorough cleanup.

Table ES-1. CY 2017 Groundwater Conditions as Compared to Other Years

Index – Groundwater Supply[1]	2017	Compared to 2016	Compared to 5-Year Average (2013 - 2017)
Managed Recharge (AF)	96,300	Down 31%	Up 16%
Groundwater Pumping (AF)	123,100	Up 15%	Down 8%
Groundwater as % of Total Water Use	42%	Up 3%	No Change
Groundwater Levels (feet, NGVD29)[2]			
Santa Clara Plain	88.7	Up 10.9 feet	Up 27.6 feet
Coyote Valley	278.5	Up 7.8 feet	Up 14 feet
Llagas Subbasin	234.3	Up 20.4 feet	Up 27.6 feet
End of Year Groundwater Storage (AF)	338,900	Up 8%	Up 15%
Land Subsidence (feet/year)[3]	0.001	Decrease	Decrease
Index - Groundwater Quality[4]	**2017**	**5-Year Step Trend[5]**	**10-Year Step Trend**
Total Dissolved Solids (TDS, mg/L)			
Santa Clara Plain	390	No Change	Decrease (~ 1 mg/L)
Coyote Valley	372	No Change	No Change
Llagas Subbasin	370	No Change	No Change
Nitrate (as Nitrogen, mg/L)			
Santa Clara Plain	3.06	No Change	No Change
Coyote Valley	7.2	No Change	No Change
Llagas Subbasin	5.2	No Change	No Change

Notes:

1. Groundwater supply and quality indices are shown for three groundwater management areas: the Santa Clara Plain and Coyote Valley (which comprise the Santa Clara Subbasin) and the Llagas Subbasin.
2. Groundwater elevations represent the average of all readings at three regional groundwater level index wells for the time period noted based on the National Geodetic Vertical Datum of 1929.
3. The District calculates the subsidence using the average measured subsidence at two extensometers over the most recent 11-year period. Measured compaction is below the established tolerable rate of 0.01 feet/year, and throughout 2017, water levels at all ten subsidence index wells were above related thresholds established to prevent permanent subsidence.
4. Values represent the median groundwater concentration for principal aquifer zone wells tested (both water supply wells and monitoring wells).
5. The median 2017 concentration for each groundwater management area was compared to that of 5 years ago (2012) and 10 years ago (2007) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

Outcome Measure Summary

The GWMP identifies outcome measures to assess performance relative to Board policy and groundwater

sustainability goals. The status of these measures using CY 2017 data is shown in Table ES-2 below, along with actions to address measures not being met. As shown in Table ES-2, all outcome measures related to groundwater storage, levels, and land subsidence were met in 2017. The rapid recovery to pre-drought conditions demonstrates the

effectiveness of significant investments in diverse water supplies and conjunctive water management, as well as close coordination with water retailers.

While most wells have stable or decreasing long-term chloride trends, increasing trends in a number of shallow aquifer wells warrant further evaluation. Elevated nitrate continues to be the primary groundwater protection challenge, particularly in South County, where a significant number of domestic wells contain nitrate above the drinking water standard. The District continues to coordinate with land use and regulatory agencies to influence policies, regulations, and decisions related to nitrate management. More directly, the District's managed recharge programs help dilute nitrate, and water quality testing and treatment system rebates help to reduce well owner exposure.

Table ES-2. Summary of 2017 Outcome Measure Performance and Action Plan

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. Estimated end of 2017 storage: 302,400 AF **OM 2.1.1.b.** Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. Estimated end of 2017 storage: 10,700 AF **OM 2.1.1.c.** Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. Estimated end of 2017 storage: 25,800 AF
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. All ten wells had groundwater levels above thresholds in 2017.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. Only 79% of wells tested in 2017 met primary drinking water standards due to elevated nitrate, mainly in South County domestic wells. If nitrate is not included, 99% of water supply wells met primary drinking water standards. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. Nearly all wells (97%) met agricultural objectives.
	Action Plan for OM 2.1.1.e: Implement Salt and Nutrient Management Plans to address nitrate, continue free domestic well testing and nitrate treatment system rebate programs, and continue collaborating with regulatory and land use agencies.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells in both the shallow and principal aquifer zones have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. This measure is not met for chloride, with 82% of wells showing stable or decreasing concentrations. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 91% and 94% of wells, respectively.
	Action Plan for OM 2.1.1.g: Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

Outcome measure met

Outcome measure not met

Status of Sustainable Groundwater Management Act (SGMA) Compliance

After a public hearing in June 2017, the District became the GSA for the small portions of the Hollister and San Juan Bautista subbasins in Santa Clara County.[4] The District is working with the San Benito County Water District, the GSA for the remainder of the subbasins, to develop a Groundwater Sustainability Plan (GSP) by January 2022. In March 2018, the District submitted the first annual report required by SGMA, which is included as an appendix. The District is awaiting DWR review of the GWMP, which was submitted as an Alternative to a GSP in December 2016. Per SGMA, DWR will review the Alternative within two years of submittal and will issue an assessment of the plan.

Groundwater Management Plan Implementation

To maintain sustainable groundwater conditions, the District continues to implement the proactive groundwater management programs and activities described in the GWMP. Chapter 6 of this report summarizes the status of the six major GWMP recommendations. Notable progress includes continued investment in high-priority capital projects (including dam safety and purified recycled water), the decision to participate in the California WaterFix, and coordination with water retailers and other stakeholders to develop a process to regulate groundwater extraction under SGMA, if needed.

Continued groundwater sustainability is central to the District mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, the District will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion," in accordance with Board policy.

[4] This followed District action in May 2016 to become the GSA for the Santa Clara and Llagas subbasins.

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2017 Annual Groundwater Report

CHAPTER 1 – INTRODUCTION

The Santa Clara Valley Water District (District) has the responsibility and authority to manage the Santa Clara and Llagas groundwater subbasins in Santa Clara County per an act of the California legislature.[1] The District also formally became the Groundwater Sustainability Agency (GSA) for these subbasins in 2016. The District's comprehensive groundwater management programs and investments described in the 2016 Groundwater Management Plan (GWMP)[2] have resulted in sustainable groundwater conditions for many decades. The District's objectives and authority related to groundwater management under the District Act are to recharge groundwater basins, conserve, manage and store water for beneficial and useful purposes, increase water supply, protect surface water and groundwater from contamination, prevent waste or diminution of the District's water supply, and do any and every lawful act necessary to ensure sufficient water is available for present and future beneficial uses.

The District Board of Directors (Board) adopted Water Supply Objective 2.1.1, which reflects the mission to protect groundwater resources: ***"****Aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion****."*** Pursuant to the District Act and Board policy, the District has identified the following basin management objectives in the GWMP:[3]

- Groundwater supplies are managed to optimize water supply reliability and minimize land subsidence.
- Groundwater is protected from existing and potential contamination, including salt water intrusion.

Purpose

This annual report describes groundwater conditions in the Santa Clara and Llagas subbasins for Calendar Year (CY) 2017 including groundwater use, recharge, water levels, water balance, storage, quality, and land subsidence. The following outcome measures (OM) derived from the GWMP are also assessed to evaluate performance in meeting Water Supply Objective 2.1.1:

- OM 2.1.1.a. Greater than 278,000 AF[4] of projected end of year groundwater storage in the Santa Clara Plain.[5]
- OM 2.1.1.b. Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley.
- OM 2.1.1.c. Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin.
- OM 2.1.1.d. 100% of Santa Clara Plain subsidence index wells with groundwater levels above subsidence thresholds.
- OM 2.1.1.e. At least 95% of countywide water supply wells meet primary drinking water standards.
- OM 2.1.1.f. At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives.

[1] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[2] Santa Clara Valley Water District, Groundwater Management Plan, November 2016.
[3] The District submitted this plan to the California Department of Water Resources as an Alternative to a Groundwater Sustainability Plan for Sustainable Groundwater Management Act compliance.
[4] AF = acre-feet. One acre-foot is equal to 325,851 gallons.
[5] As described subsequently, the District divides the Santa Clara Subbasin into two groundwater management areas: the Santa Clara Plain and the Coyote Valley.

- OM2.1.1.g. At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids.

Study Area

The Santa Clara and Llagas subbasins, located in Santa Clara County, are identified by the California Department of Water Resources (DWR) as Basin 2-9.02 and Basin 3-3.01, respectively (Figure 1). The District divides the Santa Clara Subbasin into two groundwater management areas, the Santa Clara Plain and the Coyote Valley, due to different land use and management characteristics. The Santa Clara and Llagas subbasins are separated by a groundwater divide near Cochrane Road near Morgan Hill. Groundwater in the Santa Clara Subbasin generally flows toward San Francisco Bay, while flow in the Llagas Subbasin is generally to the southeast toward the Pajaro River. The Santa Clara Plain and Llagas Subbasin have both confined and recharge areas. Within the confined areas, low permeability clays and silts separate shallow and principal aquifers, with the latter defined as aquifer materials greater than about 150 feet below ground surface. In summarizing data within this report, this concept is also applied to recharge areas, although in those areas there are no laterally-extensive aquitards forming distinct shallow and principal aquifer zones.

The information in this report is summarized by groundwater management area or by groundwater charge zone (Figure 2). Groundwater charge zones, or groundwater benefit zones, are areas where the District collects fees from well users based on the benefits received from District groundwater management activities. Zone W-2 (North County) generally coincides with the Santa Clara Plain, while Zone W-5 generally overlaps the combined area of the Coyote Valley and Llagas Subbasin.

Report Content

In addition to this Introduction, this Annual Groundwater Report for 2017 includes the following chapters:

- Chapter 2: Groundwater Pumping, Recharge, and Water Balance
- Chapter 3: Groundwater Levels and Storage
- Chapter 4: Land Subsidence
- Chapter 5: Groundwater Quality
- Chapter 6: Groundwater Management Plan Implementation

Figure 1. Santa Clara and Llagas Subbasins

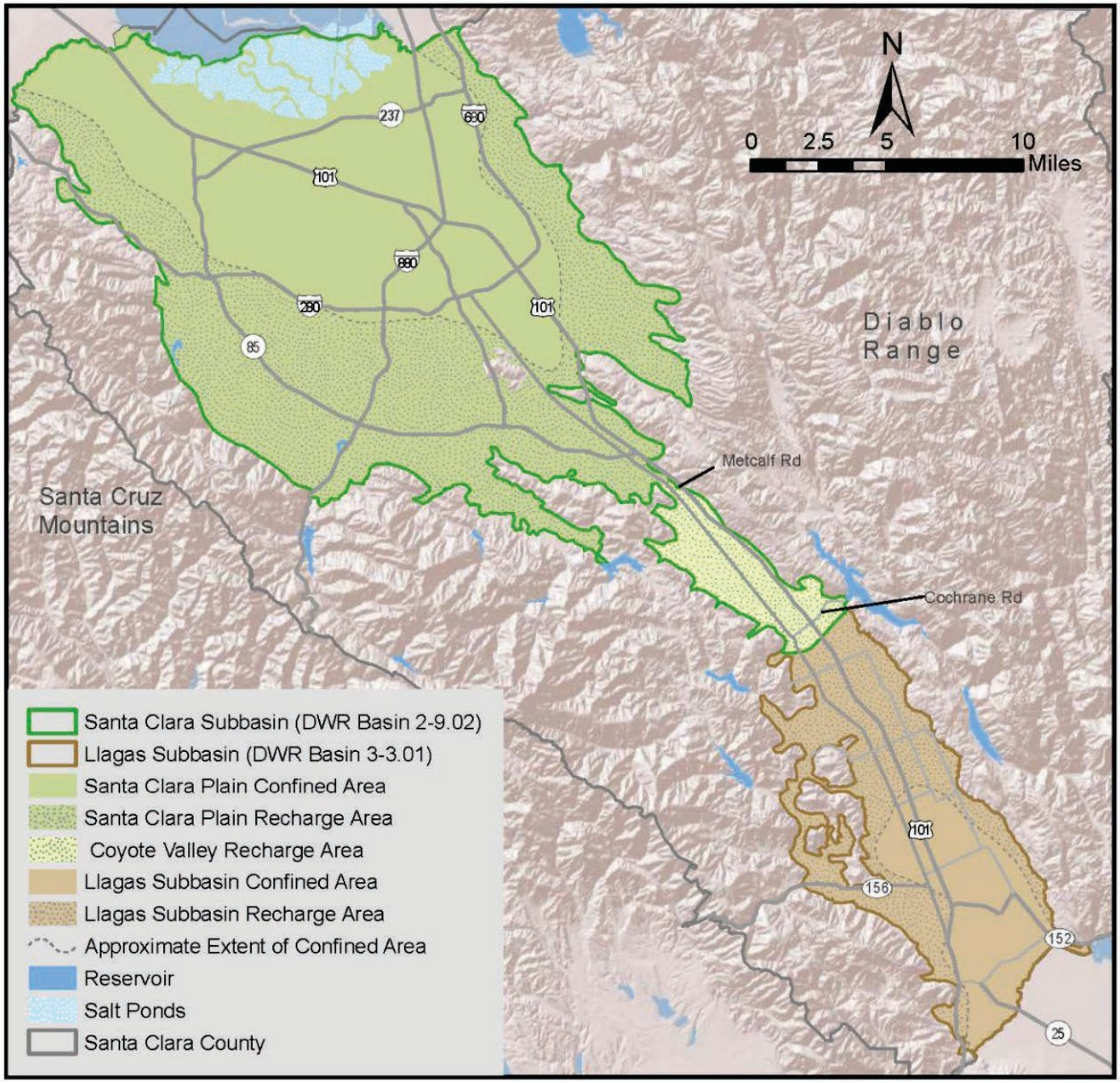
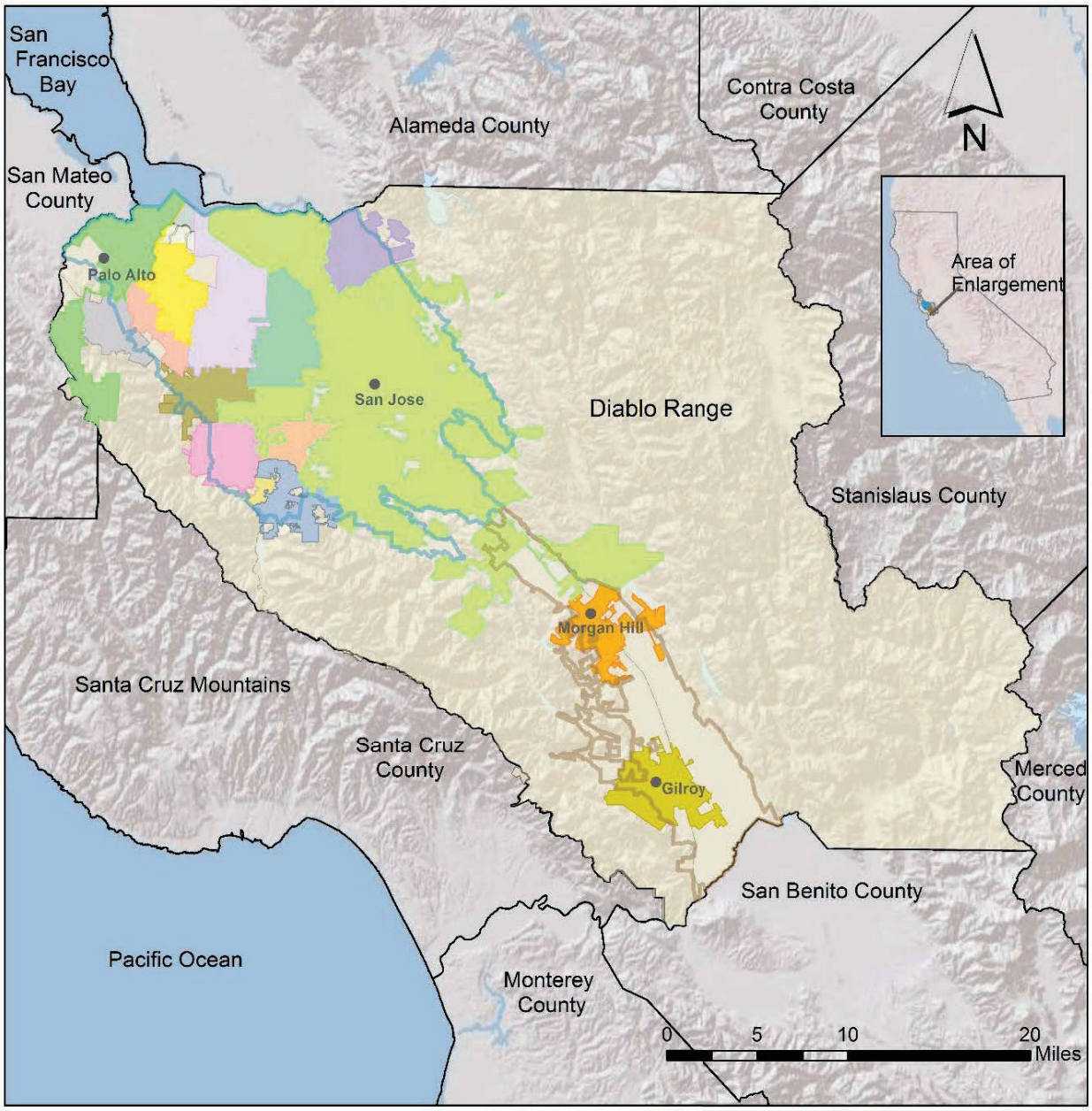


Figure 2. Groundwater Benefit Zones and Local Cities



CHAPTER 2 – GROUNDWATER PUMPING, RECHARGE, AND WATER BALANCE

Total CY 2017 groundwater pumping in Zones W-2 and W-5 was 123,000 AF, providing 42% of the total water used[1] by county residents and businesses. Compared to CY 2016, groundwater pumping increased 25% in the Santa Clara Plain, 12% in the Coyote Valley, and 1% in the Llagas Subbasin. Due to above-average rainfall and available surface water supplies, the District operated a normal managed recharge program, using about 96,000 AF of local and imported surface water to replenish the groundwater subbasins. In-lieu recharge, including treated and recycled water deliveries and water conservation programs, reduced demands on groundwater by approximately 194,000 AF.

The primary inflow to the subbasins was managed recharge, providing about 57% of the total inflow. Groundwater pumping accounted for over 87% of the subbasin outflows. Due to good water supply conditions, the inflows exceeded the outflows, resulting in a net increase in storage of 27,000 AF from CY 2016 to CY 2017.

2.1 Groundwater Pumping

Approximately 123,000 AF of groundwater was pumped in CY 2017, compared to 108,000 AF in CY 2016. Figures 3 and 4 show the locations and volumes of groundwater pumping, and Table 1 summarizes the pumping by groundwater management area and use category.

Groundwater in North County is used primarily for Municipal and Industrial (M&I) purposes, with minimal agricultural or domestic use. In South County, agricultural use is more significant. This is especially evident in the Llagas Subbasin, where 56% of the use is for agriculture. While the quantity of groundwater used for domestic purposes is relatively small in South County, there are several thousand individual wells that reported groundwater use (Table 2).

Table 1. CY 2017 Groundwater Pumping by Use (AF)

Use	Zone W-2 North County	Zone W-5 South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	69,000	9,400	16,900	95,300
Domestic	100	100	1,200	1,400
Agricultural	600	2,800	23,000	26,400
Total	**69,700**	**12,300**	**41,100**	**123,100**

Note: Large pumpers are metered and report groundwater production to the District on a monthly basis. Pumping for wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on prior year as validated data was not available by the date of publication of this report.

[1] Total water use in the county was about 292,000 AF and it came from groundwater pumping (42%), District treated water deliveries (35%), San Francisco Public Utilities Commission supplies to local retailers (16%), recycled water deliveries (6%), raw surface water deliveries (0.5%), and San Jose Water Company water rights (0.5%). This total does not reflect groundwater pumping in bedrock areas outside Zones W-2 and W-5; these areas are sparsely populated compared to the valley floor, with presumed low water use.

Table 2. Number of Wells Reporting Groundwater Use in CY 2017

Use	Zone W-2 North County	Zone W-5 South County		Total
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
Municipal & Industrial (M&I)	713	66	279	1,058
Domestic	337	351	2,602	3,290
Agricultural	47	102	590	739
Total	**1,097**	**519**	**3,471**	**5,087**

Note: Some wells may report pumping for more than one use category (e.g., domestic and agricultural). The number of wells reporting semi-annually or annually (primarily domestic and agricultural) was estimated based on prior year as validated data was not available by the date of publication of this report.

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Figure 3. CY 2017 Zone W-2 Groundwater Pumping

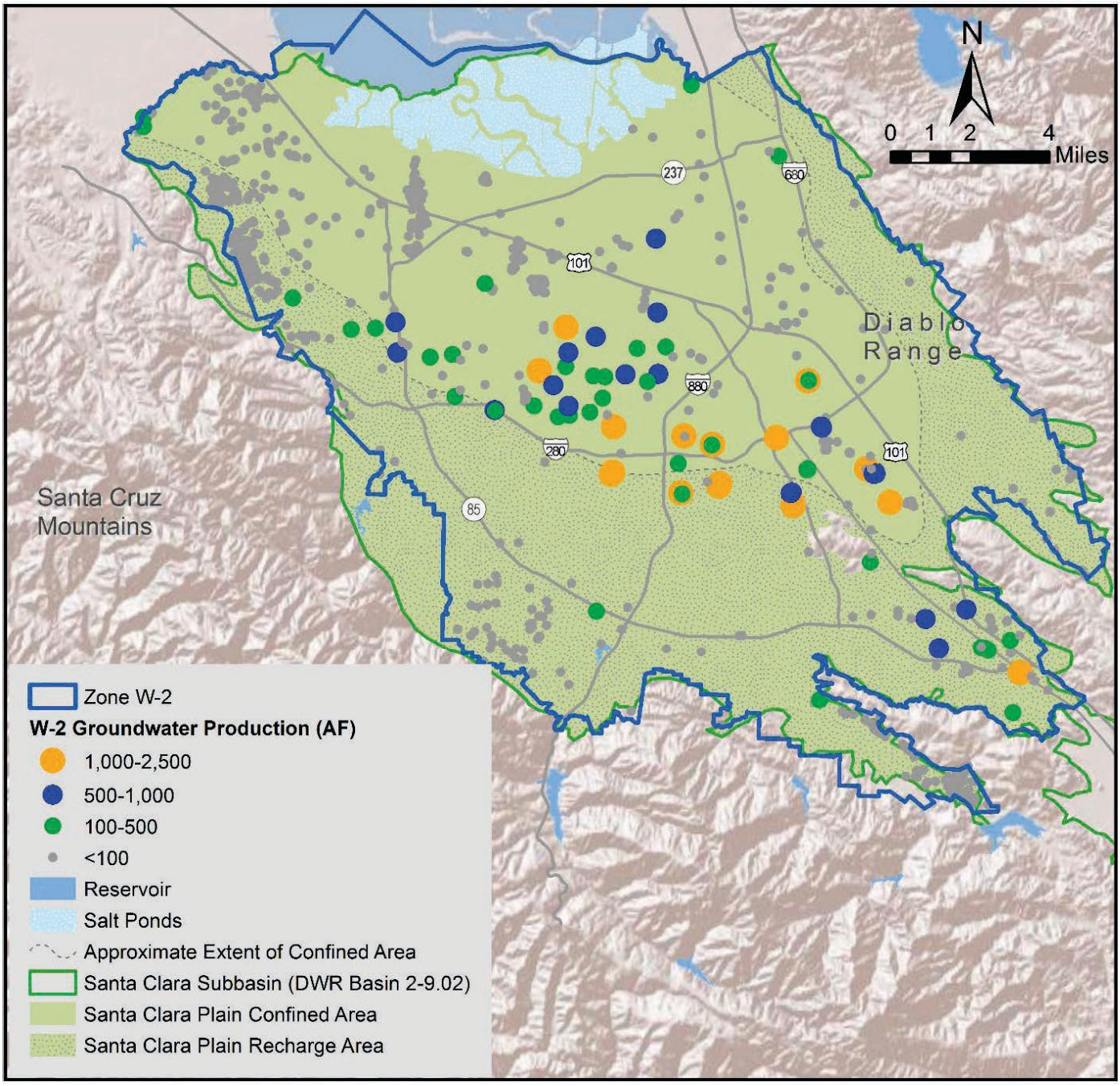
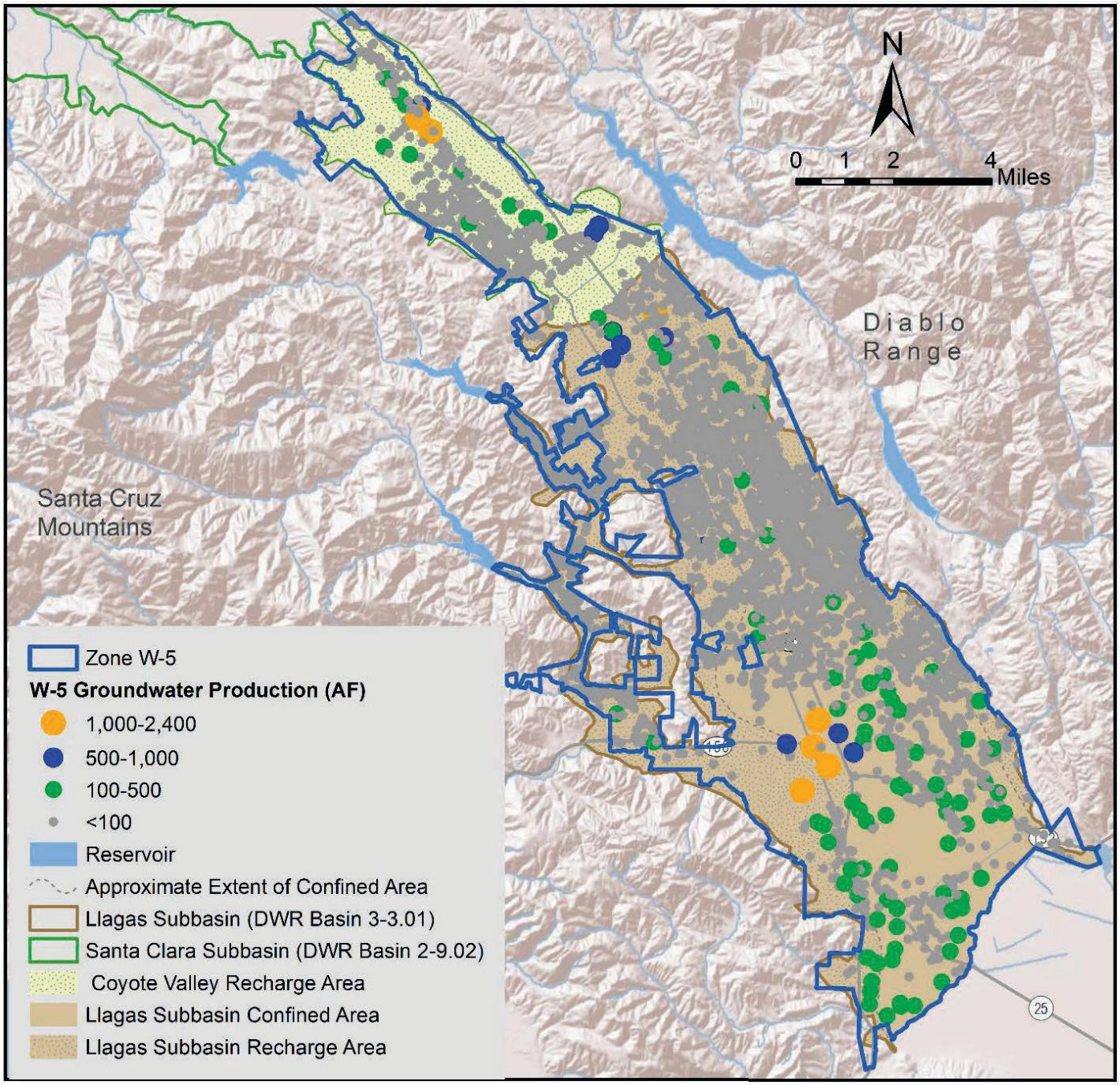


Figure 4. CY 2017 Zone W-5 Groundwater Pumping



Groundwater Pumping Trends

Groundwater pumping is largely offset by the District's managed recharge of local and imported surface water in normal or wet years (Figure 5). Over the last 12 years (2006 to 2017), natural recharge averaged 35% of the amount of groundwater pumped and managed recharge averaged 63%, thus keeping the groundwater basins almost in balance.

Countywide, total water use was about 292,000 AF in CY 2017 versus 275,000 AF in CY 2016. Countywide groundwater pumping was up about 15% from the previous year, but was still below the recent five-year average and the average pumping over the period of record (Table 3). Groundwater use increased 25% in the Santa Clara Plain, 12% in the Coyote Valley, and 1% in the Llagas Subbasin. Figure 6 shows the countywide water use by source, including groundwater, District treated water, San Francisco Public Utility Commission (SFPUC) supplies, local surface water, and recycled water. Groundwater provided 42% of the total water used countywide in CY 2017.

Groundwater pumping and use patterns over time are shown in Figure 7 for each of the groundwater management areas. In the Santa Clara Plain, a significant drop in groundwater pumping is noted in the late 1980s following completion of the District's Santa Teresa Water Treatment Plant (WTP). Since then, pumping has averaged about 98,000 AF per year. Pumping spiked in the middle of the recent drought to about 115,000 AF in 2014; however, the water retailers and community responded to the District Board's calls for water use reduction and pumping decreased during the past three years, averaging about 64,000 AF per year (AFY). A notable increase in pumping in the Coyote Valley occurred in 2006 when a water retailer installed new wells and began extracting water to serve customers in the Santa Clara Plain. This increased the average annual pumping volume by about 5,000 AF. Pumping in the Llagas Subbasin has remained relatively stable over the period of record. The period of record is 1981-2017 for the Santa Clara Plain and 1988-2017 for the Coyote Valley and Llagas Subbasin.

Table 3. CY 2017 Groundwater Pumping Compared to Other Years (AF)

Period	Zone W-2	Zone W-5		Total
	North County	South County		
	Santa Clara Plain	Coyote Valley	Llagas Subbasin	
2017	69,700	12,300	41,100	123,100
2016	55,700	11,000	40,800	107,500
5 Year Average (2013-2017)	80,200	11,200	42,700	134,100
Period of Record (Average)	**112,000**	**8,900**	**42,400**	163,300

Major Groundwater Users

The largest groundwater users in each zone are shown on Figure 8. Water retailers are the primary users in North County, accounting for over 89% of all pumping in 2017. San Jose Water Company is the largest individual user, followed

by other retailers and a few large industrial users. Unlike North County, about 51% of pumping in South County was from thousands of individual pumpers including agricultural and domestic users. In South County, water retailers' pumping accounted for about 42% of groundwater use. Other large users include golf courses and industrial users.

Figure 5. Countywide Groundwater Pumping and Managed Recharge

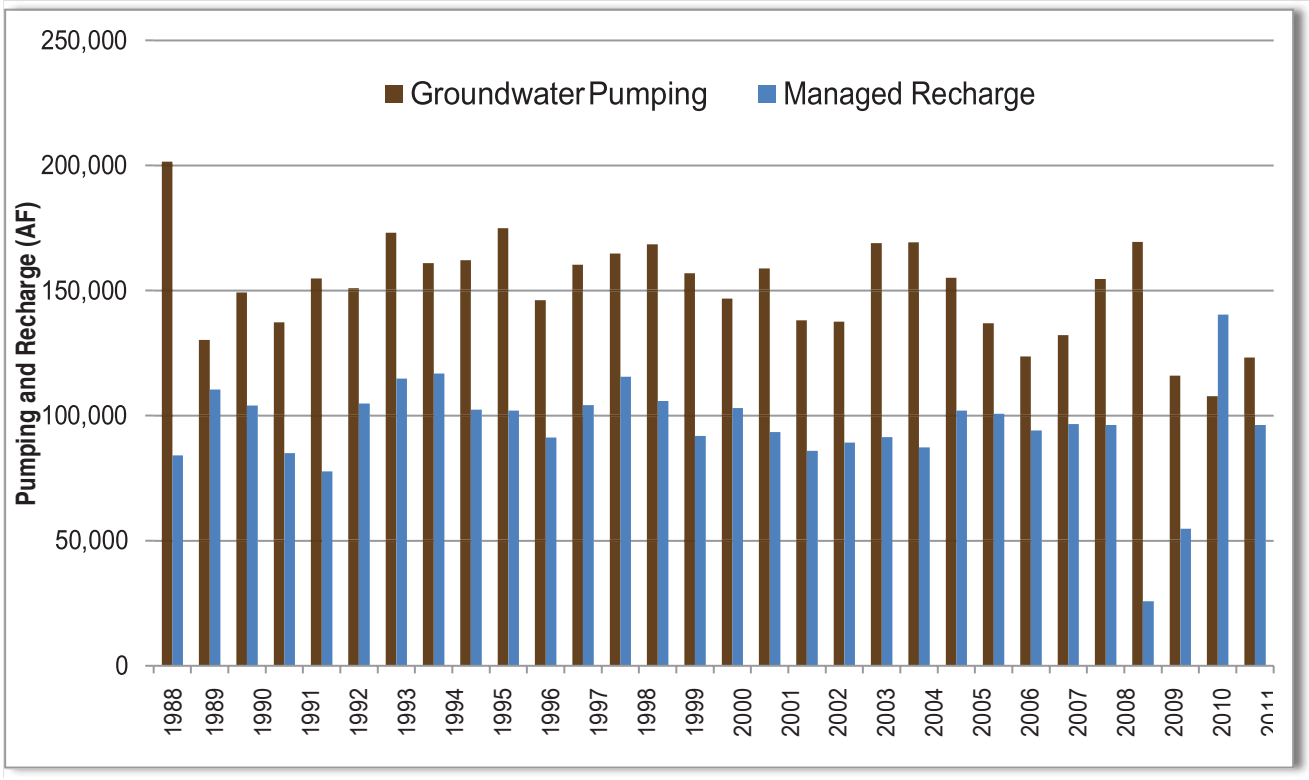


Figure 6. Countywide Water Use

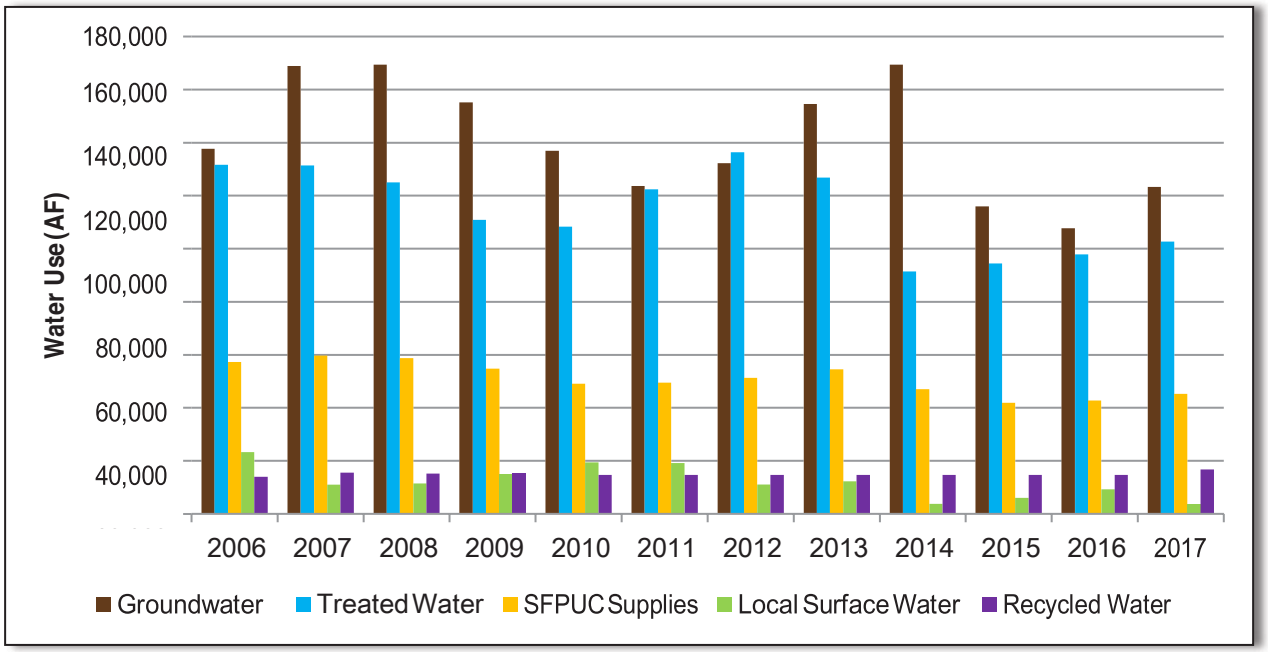
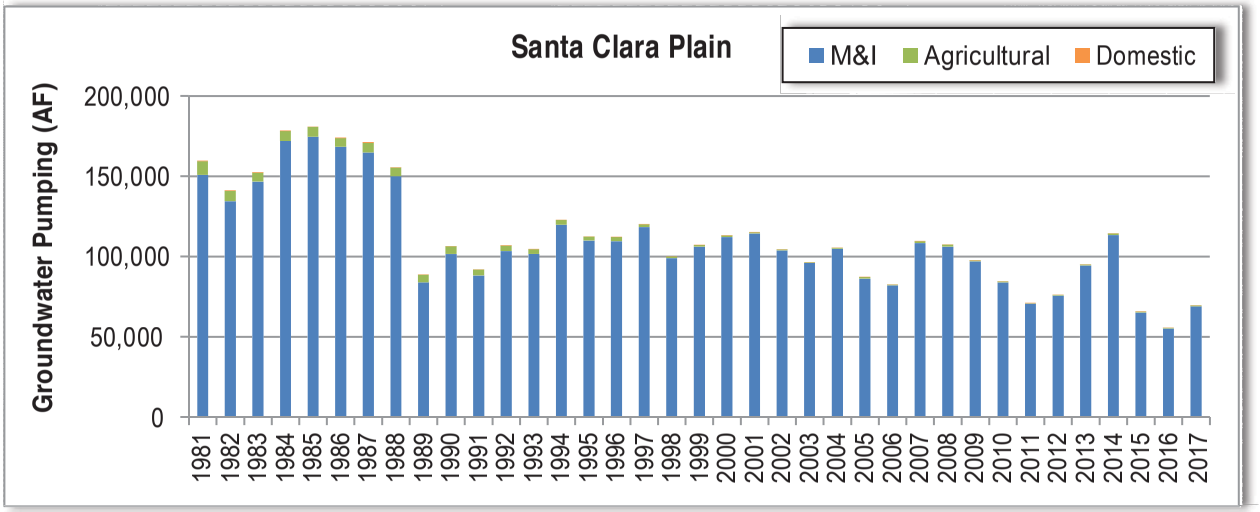
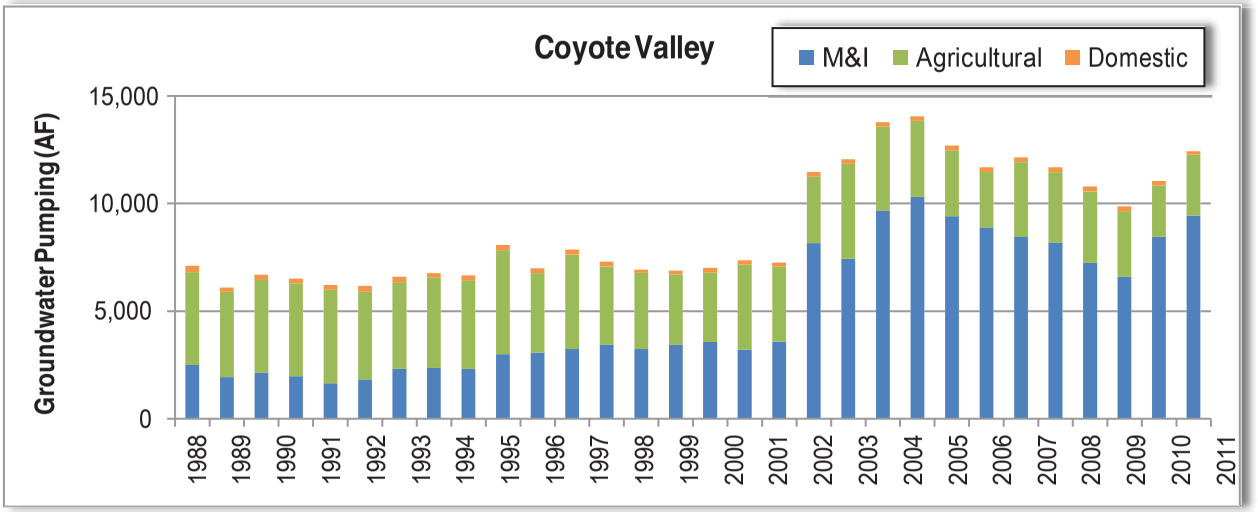


Figure 7. Groundwater Pumping by Use Category





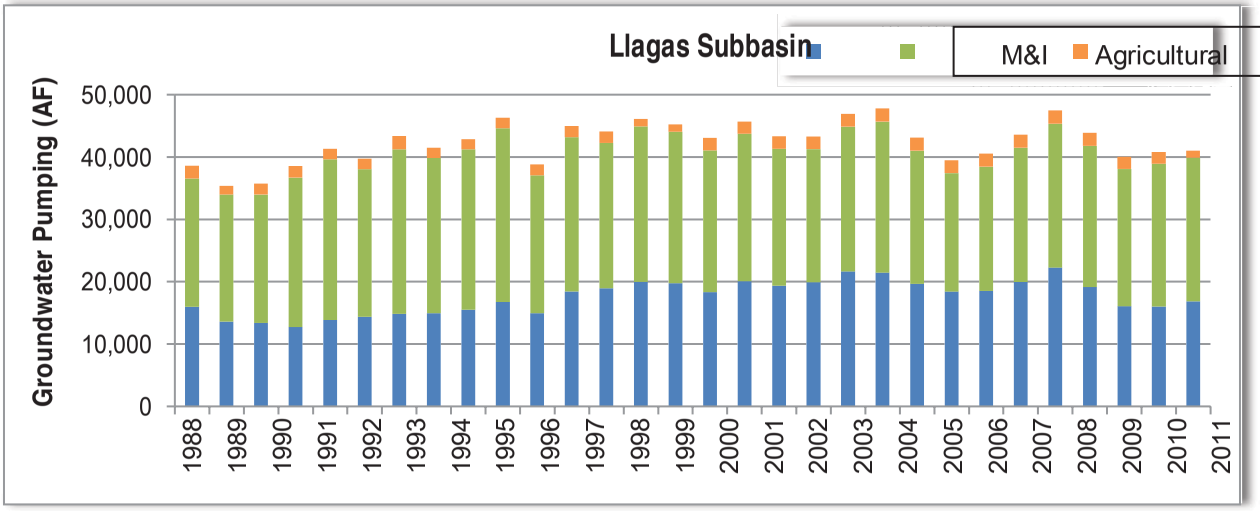
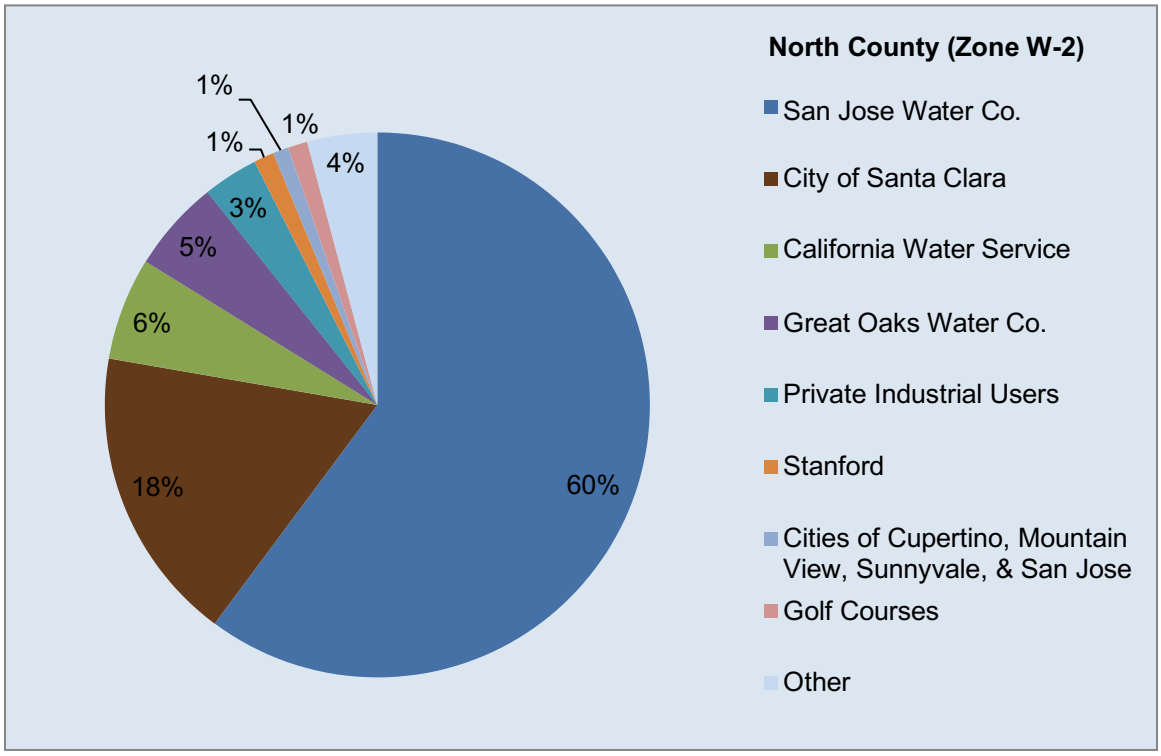
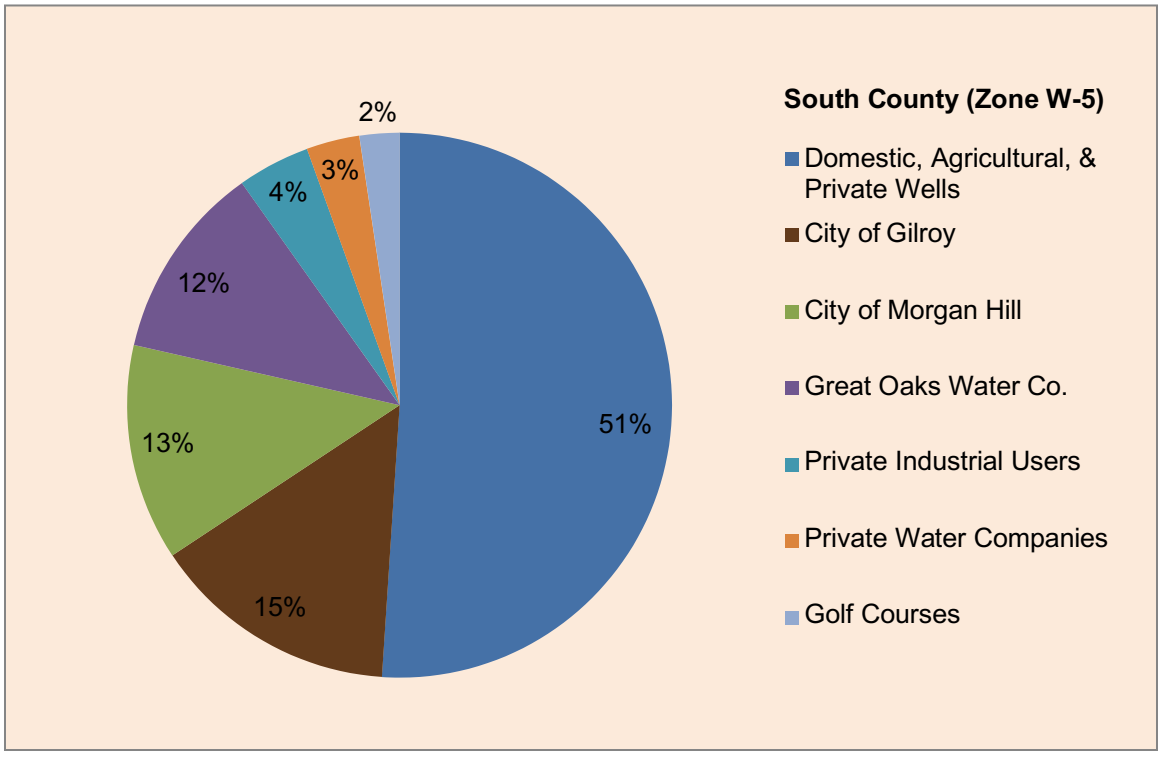


Figure 8. Percent of Total Pumping by Major Groundwater Users in 2017

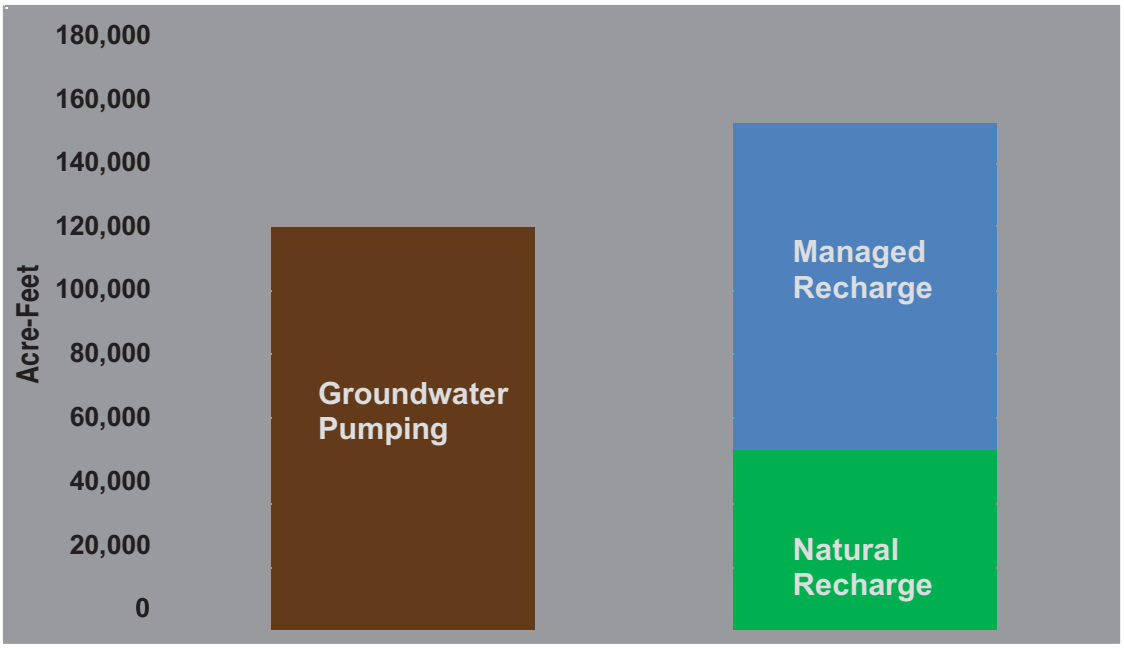




2.2 Groundwater Recharge

Since the 1930s, the District's water supply strategy has been to maximize the conjunctive management of surface water and groundwater. The annual amount of groundwater pumped far exceeds what is replenished naturally by rainfall, hence the District relies on its managed recharge and in-lieu recharge activities to ensure water supply reliability. Total recharge exceeded groundwater pumping in 2017 (Figure 9) due to below-average pumping, above-average rainfall, and the availability of surface water to operate a normal managed recharge program.

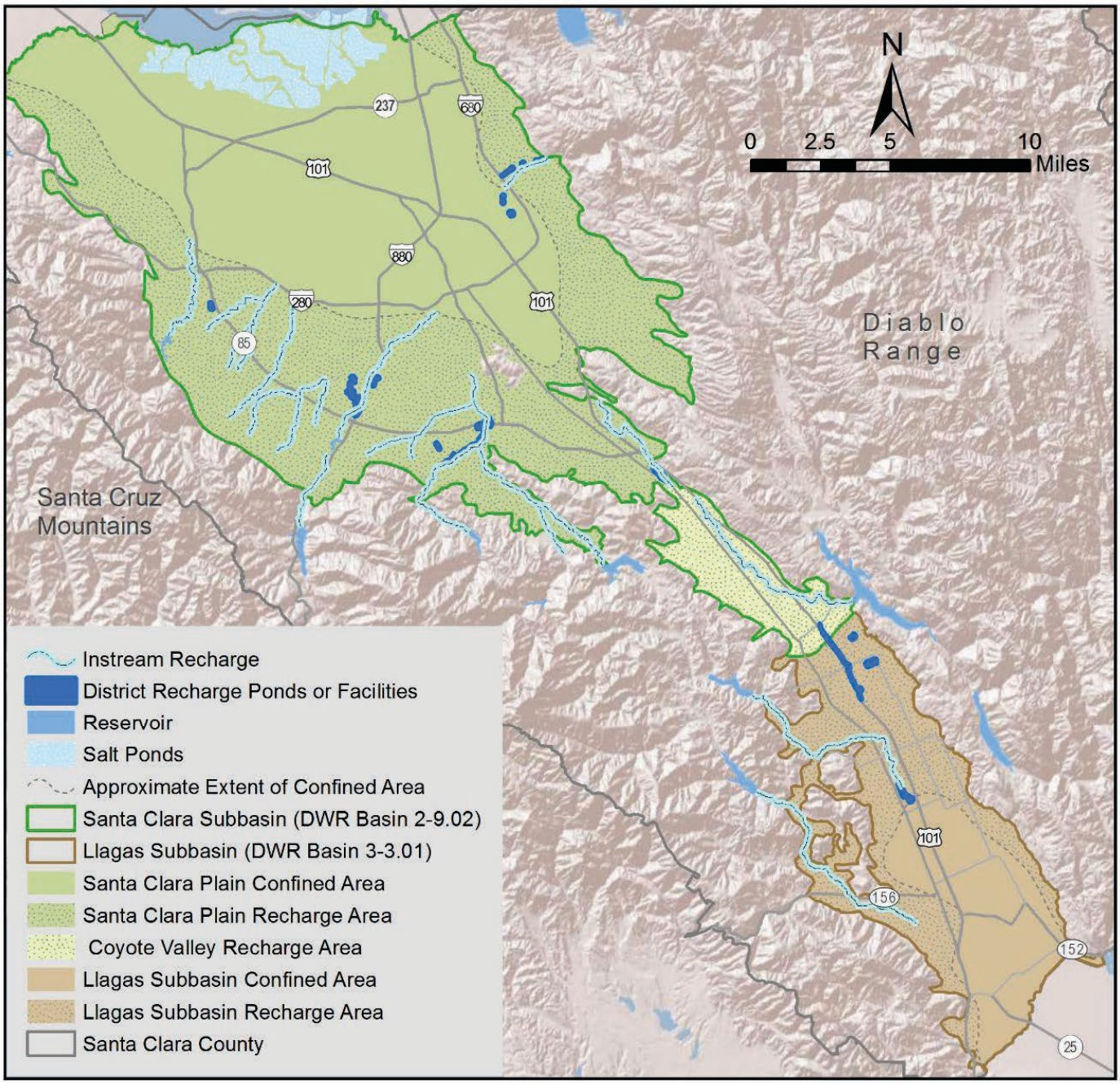
Figure 9. Countywide Groundwater Pumping and Recharge in CY 2017



Managed Recharge

The District replenishes the groundwater subbasins with imported water and surface runoff captured in 10 local reservoirs. District recharge facilities include more than 300 acres of recharge ponds and over 90 miles of creeks (Figure 10). Imported sources include the federal Central Valley Project (CVP) and the State Water Project (SWP). The amount of imported or local water used for managed recharge each year depends on many factors including hydrology, imported water allocations, treatment plant demands, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of local storm runoff in local reservoirs.

Figure 10. District Managed Recharge Facilities



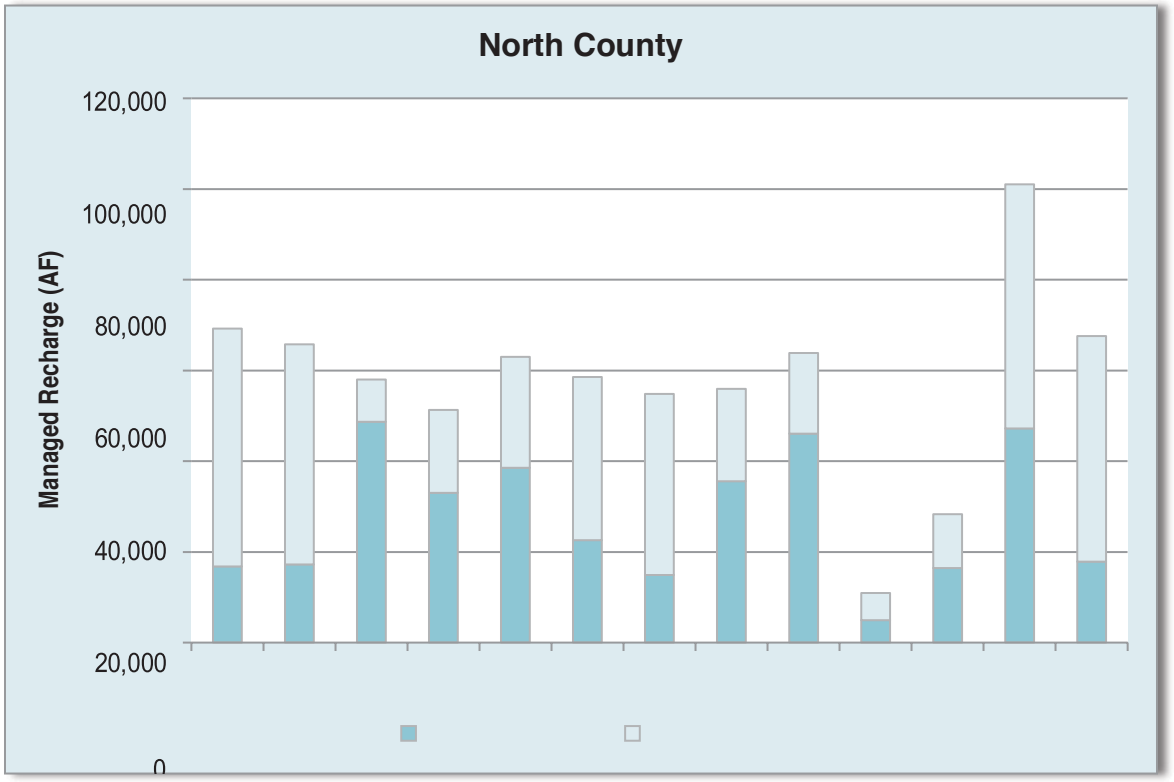
About 96,300 AF of local and imported surface water was recharged through District facilities in CY 2017 (Table 4). This is similar to the long-term (1988-2016) average of 95,700 AF. Approximately 57% of the District managed recharge in CY 2017 occurred in-stream, with the remainder through percolation ponds. Most water used for managed recharge came from local water (74% in North County and 84% in South County), whereas imported water contributed less to managed recharge in CY 2017, as shown in Figure 11.

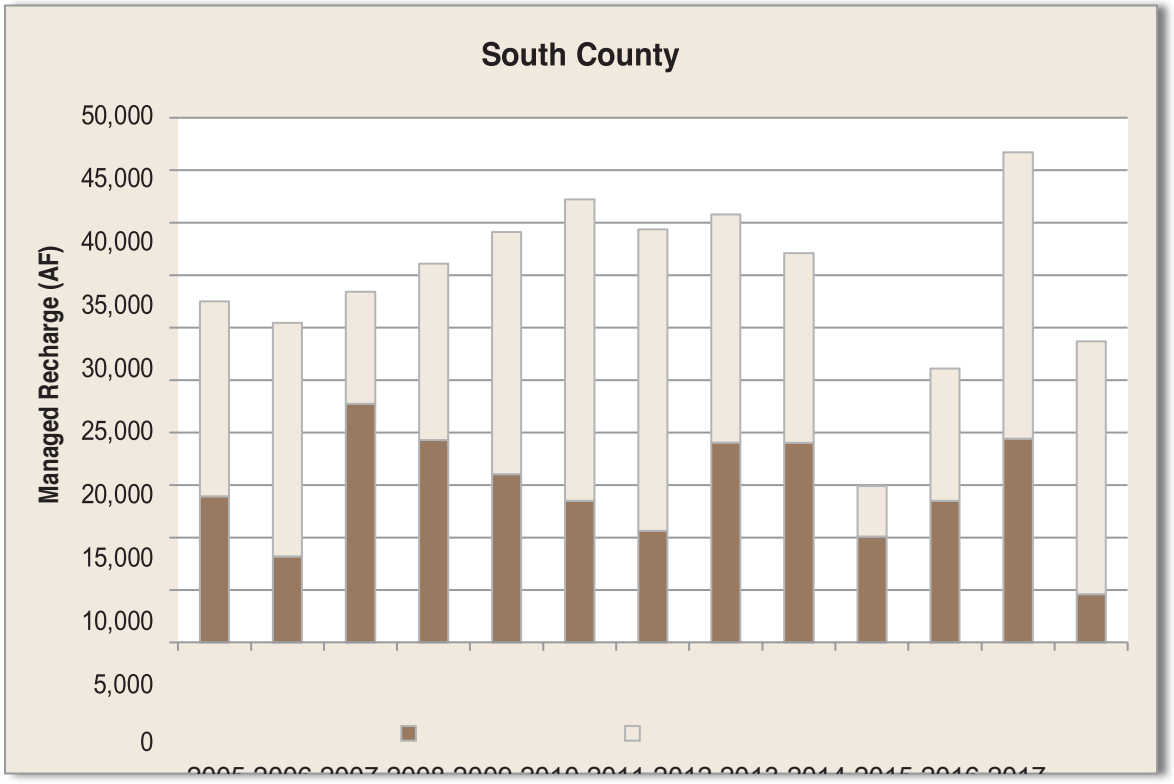
Table 4. CY 2017 Managed Recharge (AF)

Zone	In-Stream Recharge (Creeks)	Off-Stream Recharge (Recharge Ponds)	Total
W-2 (North County)	30,900	36,700	67,600
W-5 (South County)	24,300	4,400	28,700
Total	55,200	41,100	96,300

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Figure 11. Managed Recharge by Source





The District's 10 reservoirs were constructed in the 1930s and 1950s. Based on recent seismic studies, operating restrictions have been imposed on five District reservoirs while seismic stability concerns are mitigated. The dam safety operating restrictions limited the amount of water that can be stored for groundwater recharge by over 46,000 AF, but are needed to provide an adequate level of public safety. Moreover, an interim storage elevation restriction at Anderson Reservoir, the largest reservoir in the county, was approved by the California Division of Safety of Dams on May 8, 2017 following the Coyote Creek flooding of Presidents Day weekend of 2017. This elevation restriction translates into an additional loss of about 9,300 AF in storage at Anderson Reservoir. The total restrictions resulted in a loss of about one third of the total surface storage capacity at District reservoirs. Upcoming District capital projects include seismic retrofit of Anderson, Calero, and Guadalupe dams, seismic evaluations of Coyote, Chesbro, and Uvas dams, rehabilitation of Almaden Dam outlet works, replacement of Almaden Dam spillway, and rehabilitation of the Almaden-Calero Canal.

In-Lieu Recharge

The District's treated water deliveries and water conservation and recycled water programs play a critical role in maintaining groundwater storage by reducing the demand on groundwater. In 2017, treated water and recycled water provided about 103,000 and 17,000 AF of water, respectively. The District's long-term water conservation programs also saved approximately 73,000 AF in 2017.[2]

The District's Silicon Valley Advanced Water Purification Center began operating in 2014. This state-of-the-art facility in San Jose produces up to 8 million gallons per day or 9,000 AFY of highly purified water by treating recycled water with microfiltration, reverse osmosis, and ultraviolet light. Purified water is blended with tertiary-treated recycled water to improve the quality for landscape irrigation and industrial uses. This facility supports the District's goal of expanding the use of recycled and purified water, which reduces the demand on groundwater.

2.3 Groundwater Balance

The groundwater balance evaluates annual inflows and outflows for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin, as shown in Figure 12. It should be noted that some terms presented in the groundwater balance cannot be directly measured and represent estimated values from the District's calibrated groundwater flow models.

Inflows

Major inflows to the subbasins are primarily controlled by hydrologic conditions and include:

- Managed recharge by the District, using local and imported surface water; and
- Natural recharge, which includes deep percolation of rainfall, natural seepage through creeks, subsurface inflow from adjacent aquifers, water loss from transmission and distribution lines, mountain front recharge, and return

flows from septic systems and irrigation.

The District quantifies managed recharge using streamflow measurements and measured releases from reservoirs and

[2] Santa Clara Valley Water District, Protection and Augmentation of Water Supplies, 2018/2019 (PAWS), 47th Annual Report, February 2018.

raw water pipelines. Rainfall is measured at precipitation gage stations in San Jose (City of San Jose Station 131), Los Gatos (NOAA[3] Station USC00045123), Coyote Valley (District Station 37), and Morgan Hill (District Station 41). These stations provide rainfall data used in each of the three calibrated numerical groundwater models (MODFLOW) for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin. Subsurface inflows and outflows to and from adjacent aquifer systems and mountain front recharge are derived from the District's calibrated groundwater flow models. Total inflows to the subbasins were 169,000 AF in 2017, with managed District recharge providing 57% of total inflows.

Both locally and statewide, precipitation in CY 2017 was above-normal, with several storm events characterized as "atmospheric rivers" and resulting in significant surface water runoff. However, major precipitation in a relatively short period does not impact natural groundwater recharge considerably due to high runoff. Natural recharge in 2017 was 67,000 AF, approximately 20% higher than 2016.

Outflows

The primary outflow of groundwater is pumping, which accounted for 86% of the total outflow of 143,300 AF in CY 2017. The vast majority of groundwater used is metered. In Zone W-2, meters are required for wells pumping more than 1 AFY of non-agricultural water or 4 AFY of agricultural water annually. In Zone W-5, meters are required for wells producing more than 2 AFY of non-agricultural water or 20 AFY of agricultural water. Where meters are not installed, crop factors are used to determine agricultural water use, whereas domestic use is estimated from a table of average uses. Subsurface outflow to adjacent aquifer systems was about 20,200 AF, or about 14% of the total outflow.

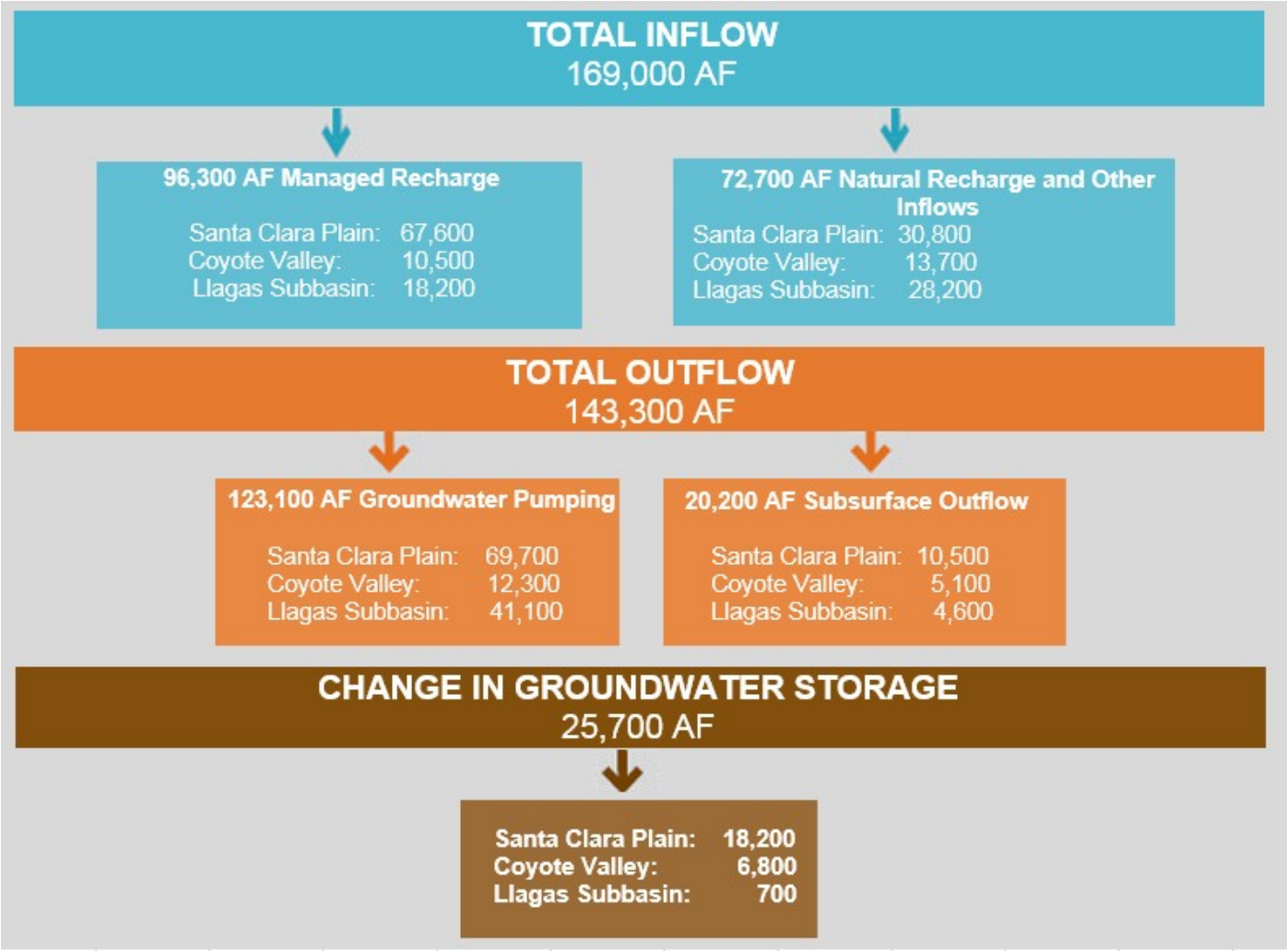
Change in Storage

Based on the inflows and outflows, there was an estimated increase in storage of 25,700 AF in CY 2017 because recharge exceeded pumping. Storage in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin increased by about 18,200 AF, 6,800 AF, and 700 AF, respectively, compared to CY 2016. This resulted in a total estimated storage of 338,900 AF, within the "Normal" stage of the District's Water Shortage Contingency Plan. Groundwater levels and storage are described in more detail in Chapter 3.

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[3] U.S. Department of Commerce National Oceanic and Atmospheric Administration (NOAA).

Figure 12. CY 2017 Groundwater Balance



Notes:

1) Groundwater balance terms presented are estimates as of May, 2018. Storage estimates are refined in other District reports as additional data becomes available. Values shown are based on measured quantities or calibrated groundwater flow models, with all values rounded to the nearest 100 AF.
2) Managed recharge represents direct replenishment by the District using local and imported water. Estimates from the groundwater models may differ slightly from surface water accounting estimates.
3) Natural recharge and other inflows include the deep percolation of rainfall, septic system and/or irrigation return flows, natural seepage through creeks, and inflow from adjacent aquifer systems.
4) The groundwater pumping estimate is based on pumping metered by the District or reported by low-volume groundwater users.
5) Subsurface outflow represents outflow to adjacent aquifer systems. In the Santa Clara Plain, this includes outflows to San Francisco Bay; in the Coyote Valley, this includes outflow to the Santa Clara Plain; and in the Llagas Subbasin, this includes outflows to the Bolsa Subbasin in San Benito County.

CHAPTER 3 – GROUNDWATER LEVELS AND STORAGE

The District collected water level measurements from 225 wells in CY 2017 and evaluated water levels from an additional 114 wells measured by water retailers. Groundwater levels throughout the county returned to pre-drought conditions, and were significantly higher than in 2016 due to improved water supply conditions and continued water use reduction. Countywide, customers served by water retailers achieved an impressive water use savings of 21% compared to CY 2013. Groundwater reserves increased by an estimated 25,700 AF during 2017 since total recharge exceeded pumping. The estimated end of 2017 groundwater storage was about 339,000 AF, which falls in the normal stage of the District's Water Shortage Contingency Plan and is well above the GWMP storage target of 300,000 AF. The projected end of year storage for CY 2018 is also well above the 300,000 AF target.

3.1 Groundwater Levels

Comprehensive and accurate monitoring data allows the District to evaluate groundwater level and storage conditions to support operational decisions and water supply planning. The District measured depth to water at 225 wells on a daily or monthly basis and evaluated data from 114 water retailer wells as shown in Figure 13. As the designated monitoring entity for Santa Clara County under the California Statewide Groundwater Elevation Monitoring (CASGEM) program, the District uploaded almost 1,200 groundwater elevation measurements for 106 wells to the CASGEM website in CY 2017.

Three groundwater level index wells are used to represent regional conditions in the Santa Clara Plain, the Coyote Valley, and the Llagas Subbasin (Figure 14). Table 5 shows March and October groundwater elevations for these index wells; these months typically represent the seasonal high and low groundwater elevations, respectively. Due to an above-average rainfall year, a normal recharge program, and below-average pumping, the average groundwater elevation was 11 feet higher than the previous year in the Santa Clara Plain, 8 feet higher in the Coyote Valley, and 20 feet higher in the Llagas Subbasin. Groundwater elevations remained well above the historical minima and levels seen during the drought of 1987-1992 (Figure 14). Like the regional index wells, water levels were near or above historical highs at many wells in 2017, indicating an impressive rebound from drought conditions with steep recovery in groundwater levels. Groundwater elevations were also well above the thresholds established to minimize the risk of land subsidence in all subsidence index wells throughout 2017.[1] All available groundwater elevation and depth-to-water data can be accessed on the District website at valleywater.org/groundwater.

In the Santa Clara Subbasin, groundwater elevations are highest in the Coyote Valley and the recharge areas of the Santa Clara Plain. Groundwater elevations generally decrease within the interior of the confined area of the subbasin as the general groundwater flow direction is northwest toward San Francisco Bay (Figure 15). The District's managed recharge program helps maintain adequate pressures in the principal aquifer zone such that groundwater flows toward the bay and maintains an upward vertical gradient near the bay. The upward gradient minimizes the potential for salt water intrusion into the principal aquifers. Artesian conditions occur in the confined area of the Santa Clara Plain and, in 2017,

an increasing number of wells indicated substantial artesian pressure.

Groundwater elevation contours for the principal aquifer zone in spring and fall of 2017 are shown in Figures 15 and 16.

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[1] To avoid resumption of permanent subsidence, the District has established subsidence thresholds at ten index wells in the Santa Clara Plain as described further in Chapter 4.

The spring and fall maps were created using the water level measurements closest to March 31, 2017 and September 30, 2017, respectively. The typical seasonal pattern observed is groundwater levels that peak in the spring and decline through the summer and fall due to increased pumping and less natural recharge. While this pattern is visible in Figures 15 and 16, the change is not as pronounced as some past years due to lowered water use and reduced pumping by major retailers.

Table 5. Groundwater Elevations at Regional Index Wells (feet, NGVD29[2])

Groundwater Subbasin/Area	Index Well	March 2017	October 2017	2017 Average	2016 Average	5 Year Average (2013-2017)	Period of Record Average
Santa Clara Subbasin, Santa Clara Plain	07S01W25L001	90.1	89.9	88.7	77.8	61.1	11.4
Santa Clara Subbasin, Coyote Valley	09S02E02J002	284.3	272.9	278.5	270.7	264.5	264.5
Llagas Subbasin	10S03E13D003	242.6	228.6	234.3	213.9	206.7	217.9

Note: The period of record for the index wells is 1936-2017 for the Santa Clara Plain, 1948-2017 for the Coyote Valley, and 1969-2017 for the Llagas Subbasin.

The 2017 groundwater flow patterns observed in South County were similar to those observed in the past. In Coyote Valley, the highest elevations are at the subbasin divide near Cochrane Road and groundwater generally flows toward the northwest. The highest groundwater elevations in the Llagas Subbasin are in the recharge area in Morgan Hill, and groundwater generally flows southeast toward the Pajaro River and San Benito County. Managed and natural recharge within the recharge area maintains groundwater pressures within the confined area, where deeper groundwater occurs in partially to fully confined (artesian) conditions. Similar to the Santa Clara Plain, artesian pressures increased in some wells in 2017.

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[2] National Geodetic Vertical Datum of 1929.

Figure 13. CY 2017 Groundwater Level Monitoring

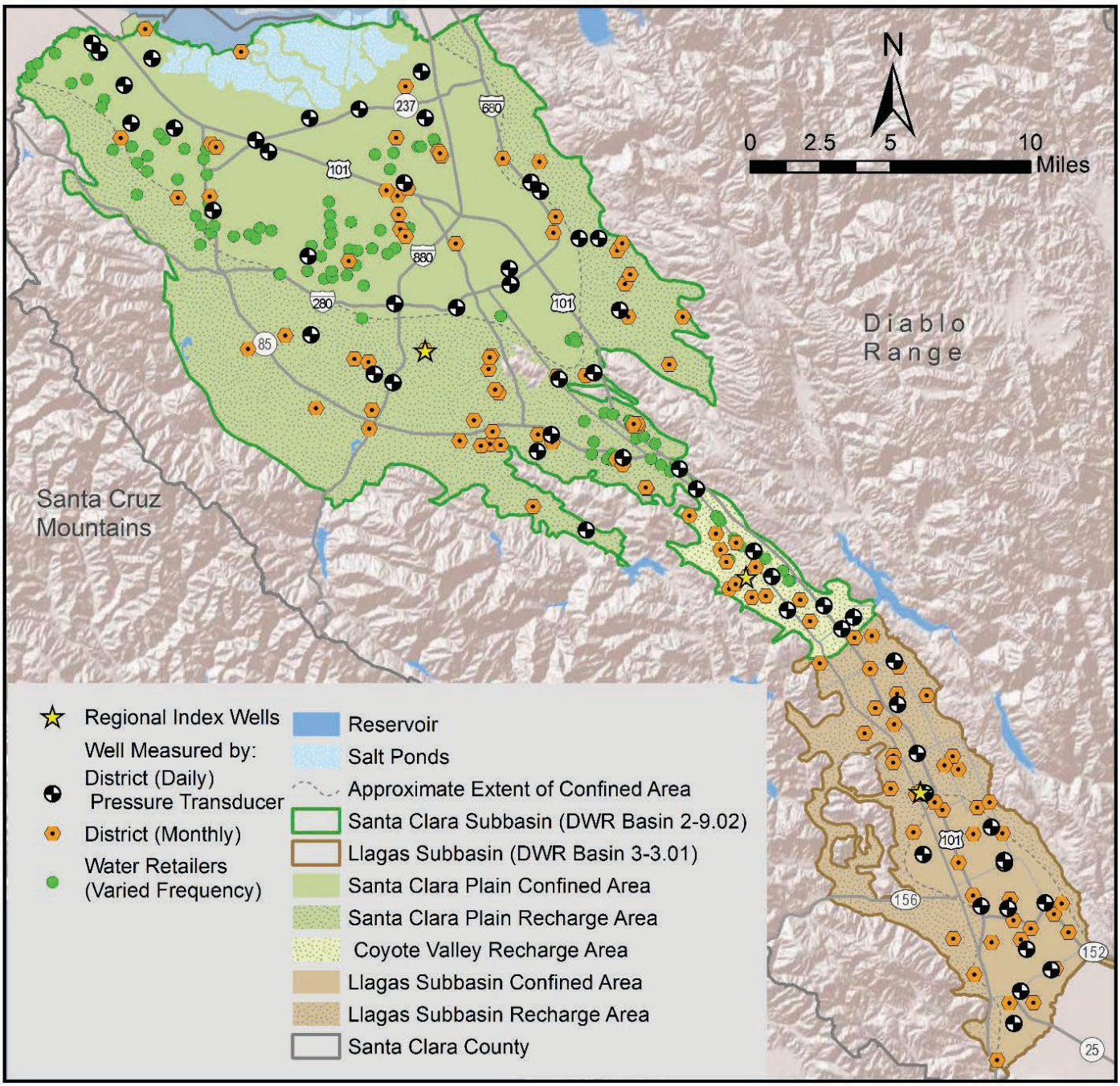


Figure 14. Groundwater Elevations at Regional Index Wells

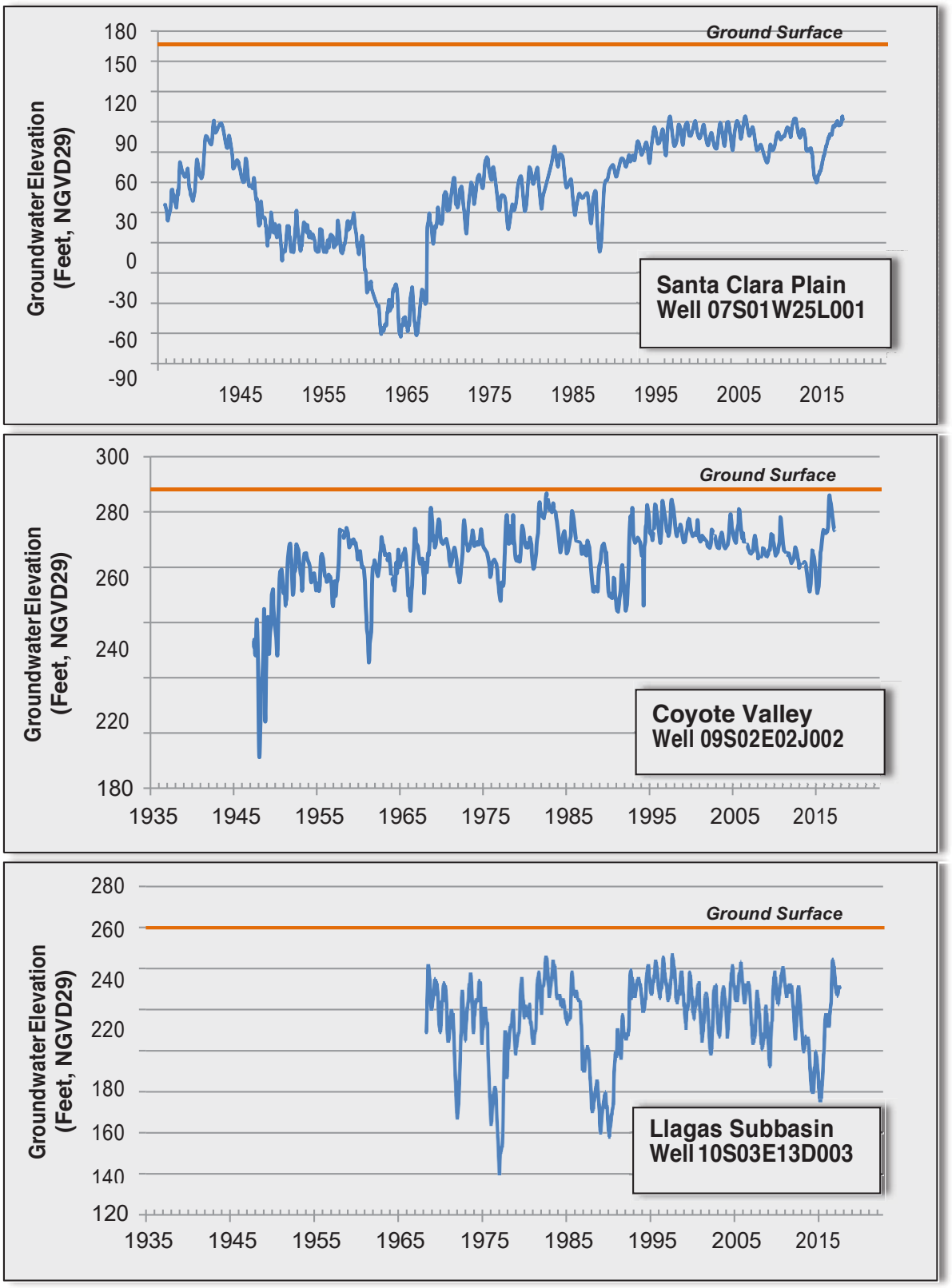


Figure 15. Spring 2017 Groundwater Elevation Contours in the Principal Aquifer

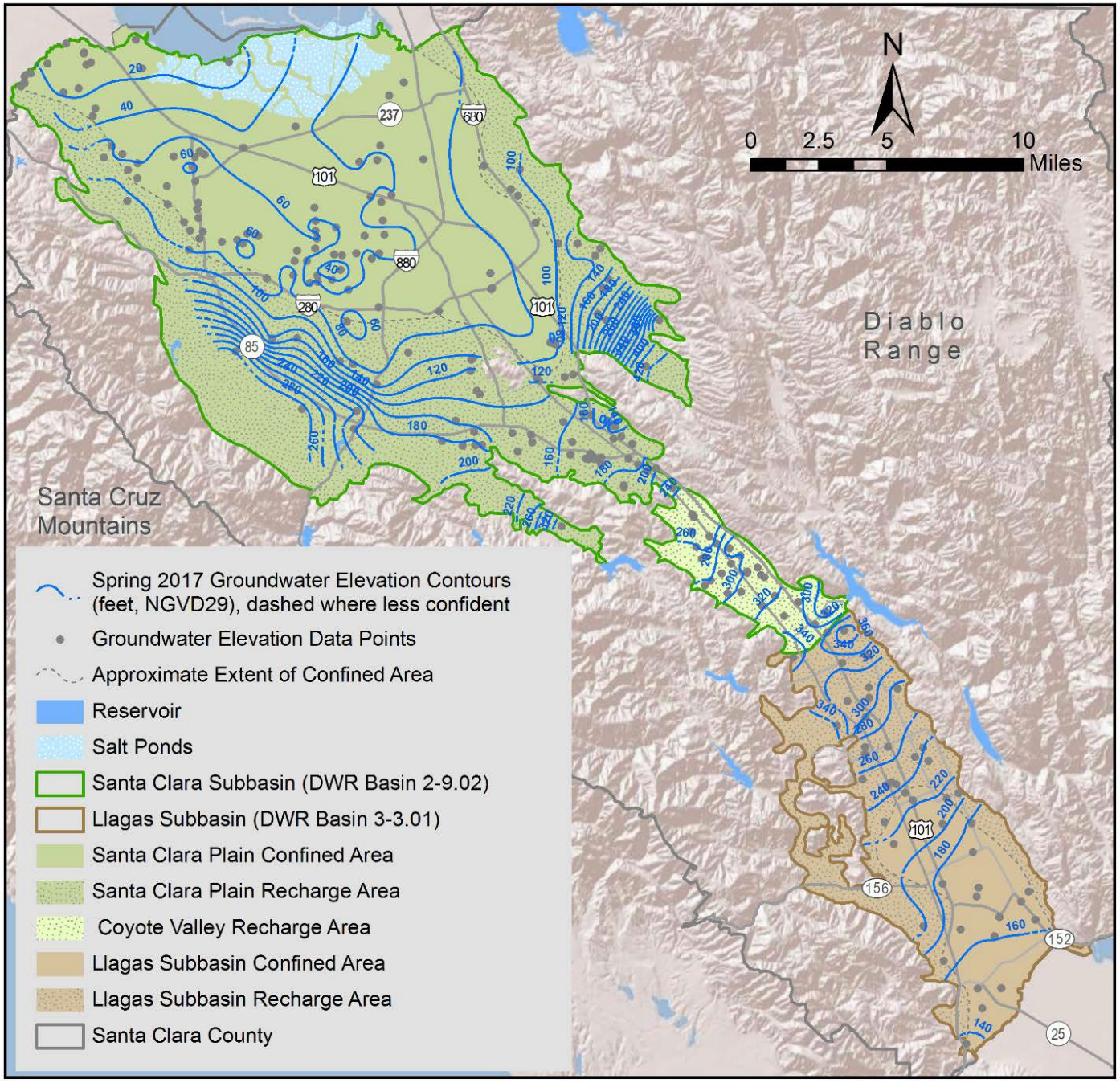
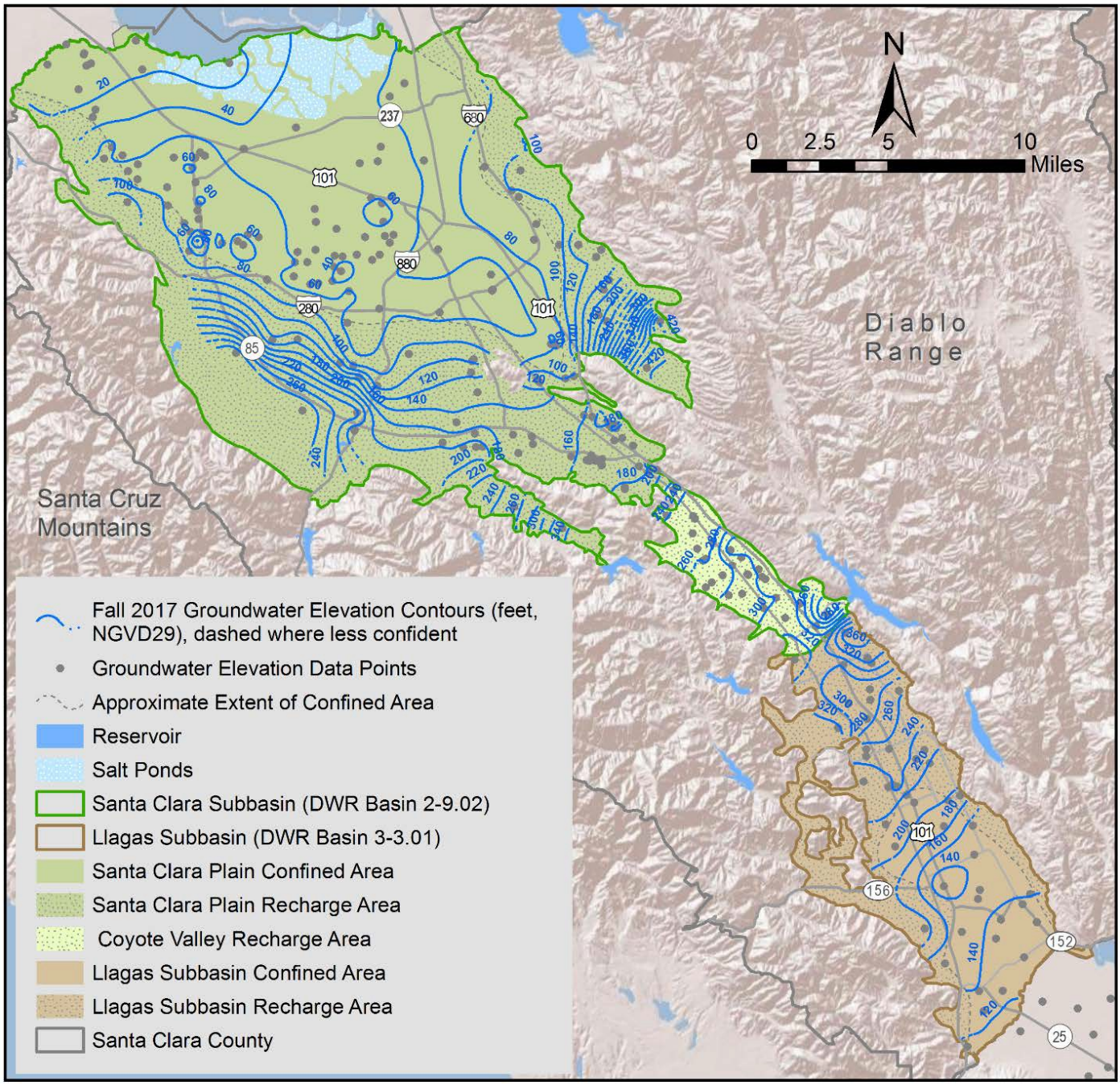


Figure 16. Fall 2017 Groundwater Elevation Contours in the Principal Aquifer



3.2 Groundwater Storage

Estimated groundwater storage at the end of 2017 was about 338,900 AF; this is well above the GWMP outcome measure of 300,000 AF, and 25,700 AF higher than at the end of 2016 (Table 6). End of year groundwater storage of more than 300,000 AF falls within the normal stage (Stage 1) of the District's Water Shortage Contingency Plan, indicating good water supply conditions. The projected end of year storage for 2018 is well above the 300,000 AF target.

Table 6. Estimated End of Year Groundwater Storage (AF)

Groundwater Subbasin/Area	GWMP Outcome Measure	End of Year 2016	End of Year 2017	Change in Storage
Santa Clara Subbasin Santa Clara Plain	278,000	284,200	302,400	+18,200
Santa Clara Subbasin Coyote Valley	5,000	3,900	10,700	+6,800
Llagas Subbasin	17,000	25,100	25,800	+700
Total	**300,000**	**313,200**	**338,900**	**+25,700**

Note: Groundwater storage estimates presented are as of May, 2018. These estimates are based on accumulated groundwater storage since 1970, 1991, and 1990 for the Santa Clara Plain, Coyote Valley, and Llagas Subbasin, respectively. These estimates are refined as additional pumping and managed recharge data become available.

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Groundwater Storage Outcome Measures

OM 2.1.1.a.
Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain.

OM 2.1.1.b
Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley.

OM 2.1.1.c.
Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin.

These outcome measures were met in 2017. The estimated end of year storage was 302,400 AF for the Santa Clara Plain, 10,700 AF for Coyote Valley, and 25,800 AF for the Llagas Subbasin.

CHAPTER 4 – LAND SUBSIDENCE

In CY 2017, the District monitored subsidence at 143 benchmarks along three cross valley level circuits and at two extensometers in the Santa Clara Plain. Water levels at ten subsidence index wells were also monitored and compared to thresholds established to minimize the risk of permanent land subsidence. The subsidence outcome measure was met in 2017. Subsidence is a concern because it can lead to an increased risk of flooding, salt water intrusion, and damage to settlement-sensitive infrastructure and utilities. Subsidence has not been observed in the Coyote Valley or Llagas Subbasin.

The Santa Clara Plain is vulnerable to land subsidence. Between 1915 and 1969, about 13 feet of inelastic (permanent) land subsidence was observed in San Jose due to groundwater overdraft. Significant inelastic subsidence was essentially halted by about 1970 through the District's expanded conjunctive water management programs, which allowed artesian groundwater heads to recover. Elastic subsidence and recovery occurs annually[1] in response to seasonal pumping and recharge as indicated by extensometer measurements (Appendix A). To avoid resumption of permanent (inelastic) subsidence, the District has established subsidence thresholds at ten index wells in the Santa Clara Plain.[2] A tolerable rate of 0.01 feet per year of subsidence[3] was used to determine thresholds at these wells. These subsidence thresholds are the groundwater levels that must be maintained to ensure a low risk of land subsidence.

The District conducts ongoing monitoring of benchmarks on the land surface, extensometers, and groundwater levels at subsidence index wells to determine if land subsidence is occurring or threatening to exceed established thresholds. Subsidence monitoring points are shown in Figure 17. Recent monitoring data from extensometers, benchmark surveys, and subsidence index wells indicates a low risk of subsidence, as described further below and in the 2017 Subsidence Data Analysis Technical Memorandum (Appendix A).

4.1 Extensometer Monitoring

The District monitors two 1,000-foot deep extensometers that measure vertical ground motion (or aquifer compaction) relative to a central, isolated pipe set beneath the water-bearing units. The extensometers, located in Sunnyvale near Moffett Field ("Sunny") and near downtown San Jose ("Martha"), are equipped with data loggers to provide hourly aquifer compaction and water level readings. The District evaluates the average land subsidence measured during the last 11 years to determine if it meets the tolerable rate of land subsidence of 0.01 feet/year.

Figure 18 shows cumulative compaction measured at the extensometers for the period of record supplemented with nearby benchmark data. These figures indicate that land subsidence over the last few decades has been negligible. The figures also show close correlation between the District's land subsidence model and actual measured data. Measured data show a negative compaction (i.e., aquifer expansion) at both sites in 2017. The average subsidence rate over the

[1] Schmidt, D. A., and R. Bürgmann, 2003, Time-dependent land uplift and subsidence in the Santa Clara valley, California, from a large interferometric synthetic aperture radar data set, *J. Geophysical Res., 108*(B9), 2003.

[2] Geoscience Support Services Inc. for Santa Clara Valley Water District, Subsidence Thresholds in the North County Area of Santa Clara Valley, 1991.

[3] The tolerable subsidence rate of no more than 0.01 feet per year on average was endorsed by the District's Water Retailer Groundwater Subcommittee.

last 11 years (2007 to 2017) is 0.001 feet/year, which is below the tolerable subsidence rate of 0.01 feet/year. The average for the previous period (2006 to 2016) was 0.002 feet/year. The decreased average subsidence rate results from groundwater level recovery in 2017 following the extended drought. Measured compaction is within the elastic range observed historically, but the District will continue to closely monitor land subsidence conditions.

4.2 Benchmark Elevation Surveys

Periodic benchmark surveys of land surface elevation have been conducted in Santa Clara County since 1912.[4] The District's current benchmark leveling program consists of annual surveys along three cross valley level circuits in the Santa Clara Plain (Figure 17). In 2017, the District analyzed land surface elevation data from 143 benchmarks to evaluate the spatial variability of land subsidence. Survey data at most benchmarks show the land surface rising in 2017, with uplift averaging 0.01 to 0.04 feet along the three circuits. This uplift is due to annual recharge exceeding pumping. Regional benchmark data is consistent with extensometer data, indicating the average annual change of land surface over the last 11 years does not exceed the tolerable rate of subsidence of 0.01 feet per year.

4.3 Subsidence Index Wells

Groundwater level measurements are an integral part of land subsidence monitoring because declining water levels due to long-term overdraft were the driving force of historical subsidence in the Santa Clara Plain. The District measures water levels at ten subsidence index wells on a daily to monthly basis to ensure they remain above established thresholds. If water levels drop below subsidence thresholds for extended periods, permanent land subsidence may resume, resulting in an increased risk of flooding, salt water intrusion, and damage to infrastructure and utilities.

Figure 19 shows groundwater levels and subsidence thresholds at ten subsidence index wells. The lowest historical water levels were generally observed in the 1960s and 1970s. Since then, groundwater levels have recovered, primarily due to the District's managed recharge and in-lieu recharge programs. Similar to the regional index wells, 2017 average water levels were higher than 2016 in all subsidence index wells, indicating further recovery since the drought. Three subsidence index wells located near the Baylands continue to have upward vertical gradients. In addition to keeping water levels above subsidence thresholds, maintaining an upward hydraulic gradient in principal aquifer zone wells is critical for preventing shallow groundwater with elevated salts from entering the principal aquifer through abandoned wells and other vertical conduits. The District will continue to frequently track data from the subsidence index wells to support water supply operations and planning.

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[4] USGS, Land Subsidence in the Santa Clara Valley, California as of 1982, Professional Paper 497-F, 1988.

Figure 17. CY 2017 Land Subsidence Monitoring

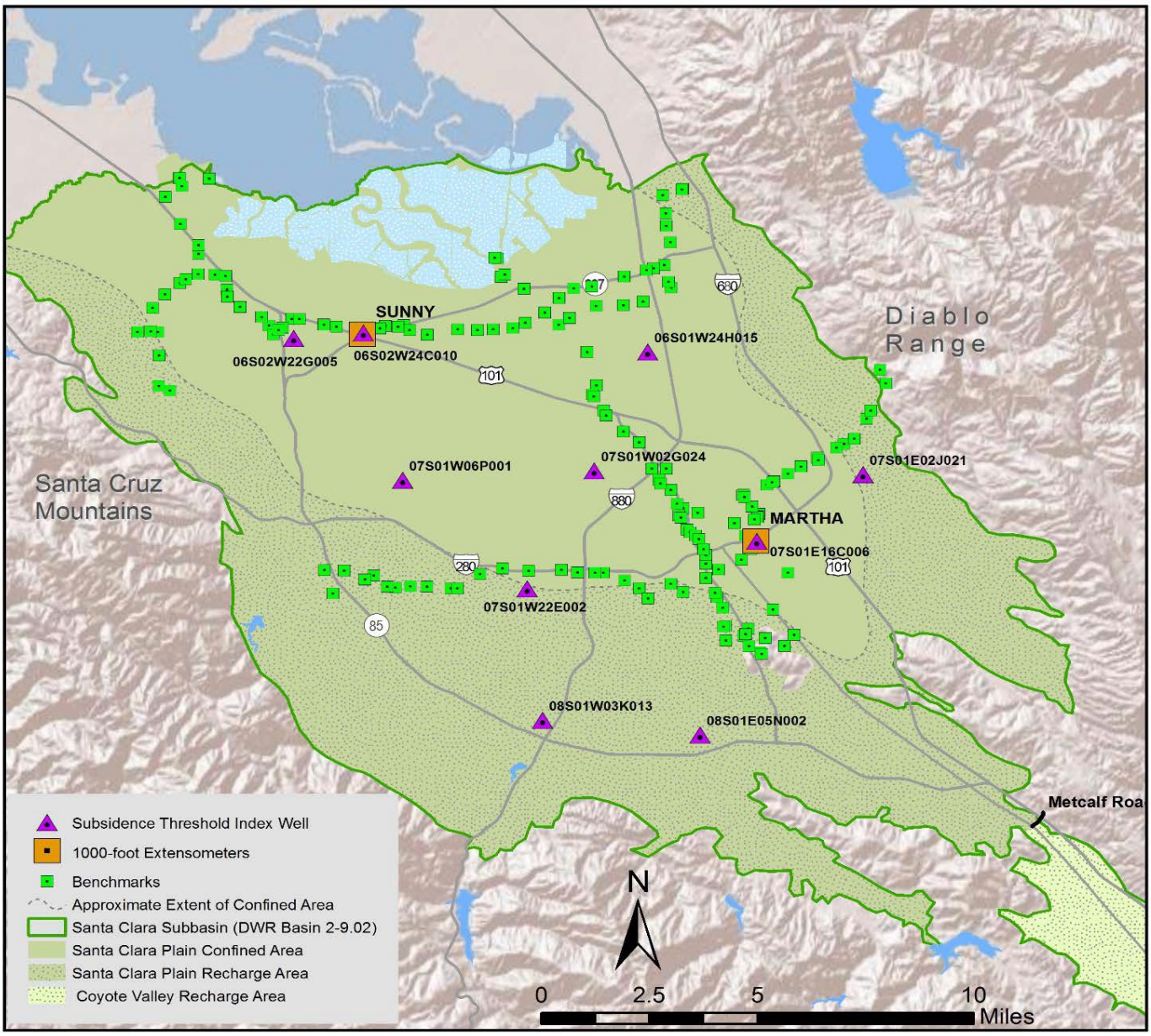
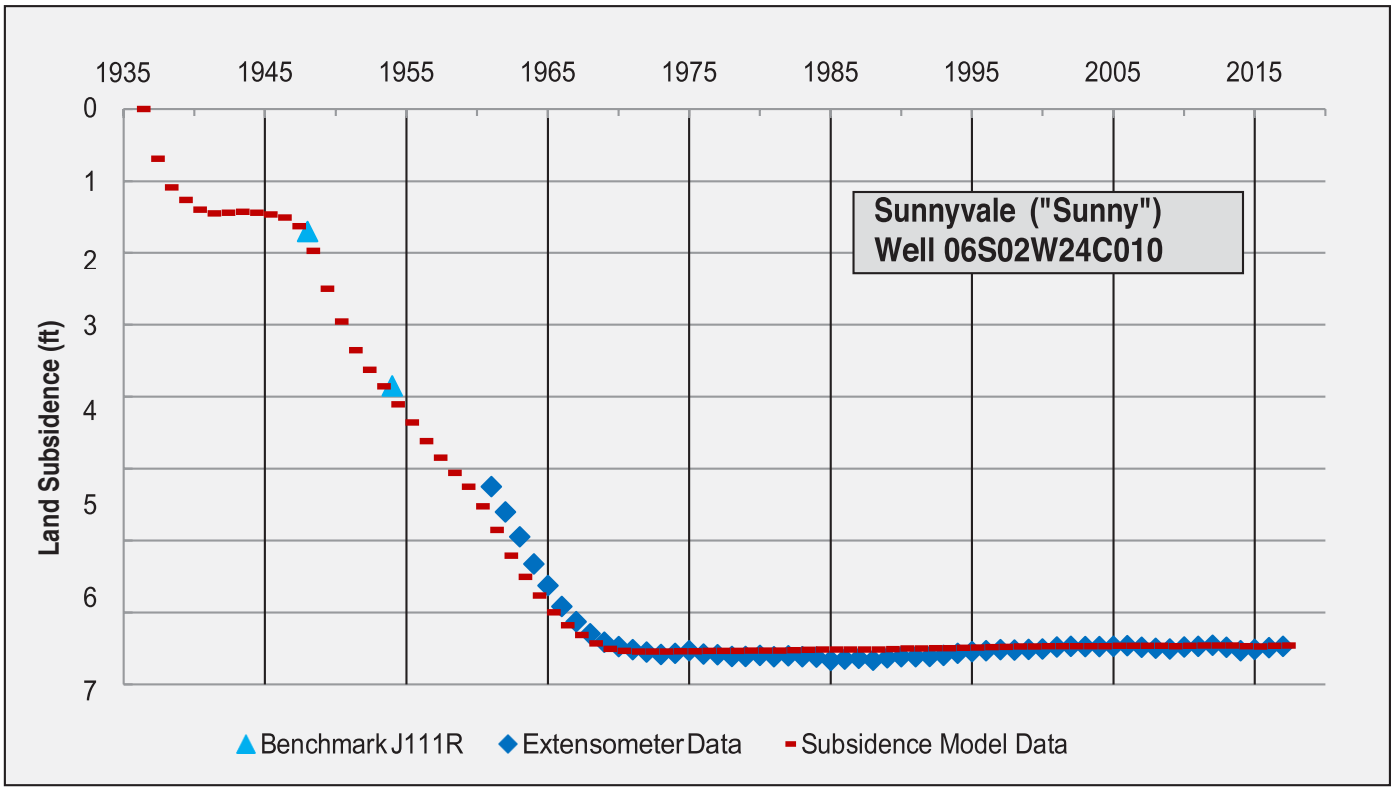


Figure 18. Cumulative Land Subsidence



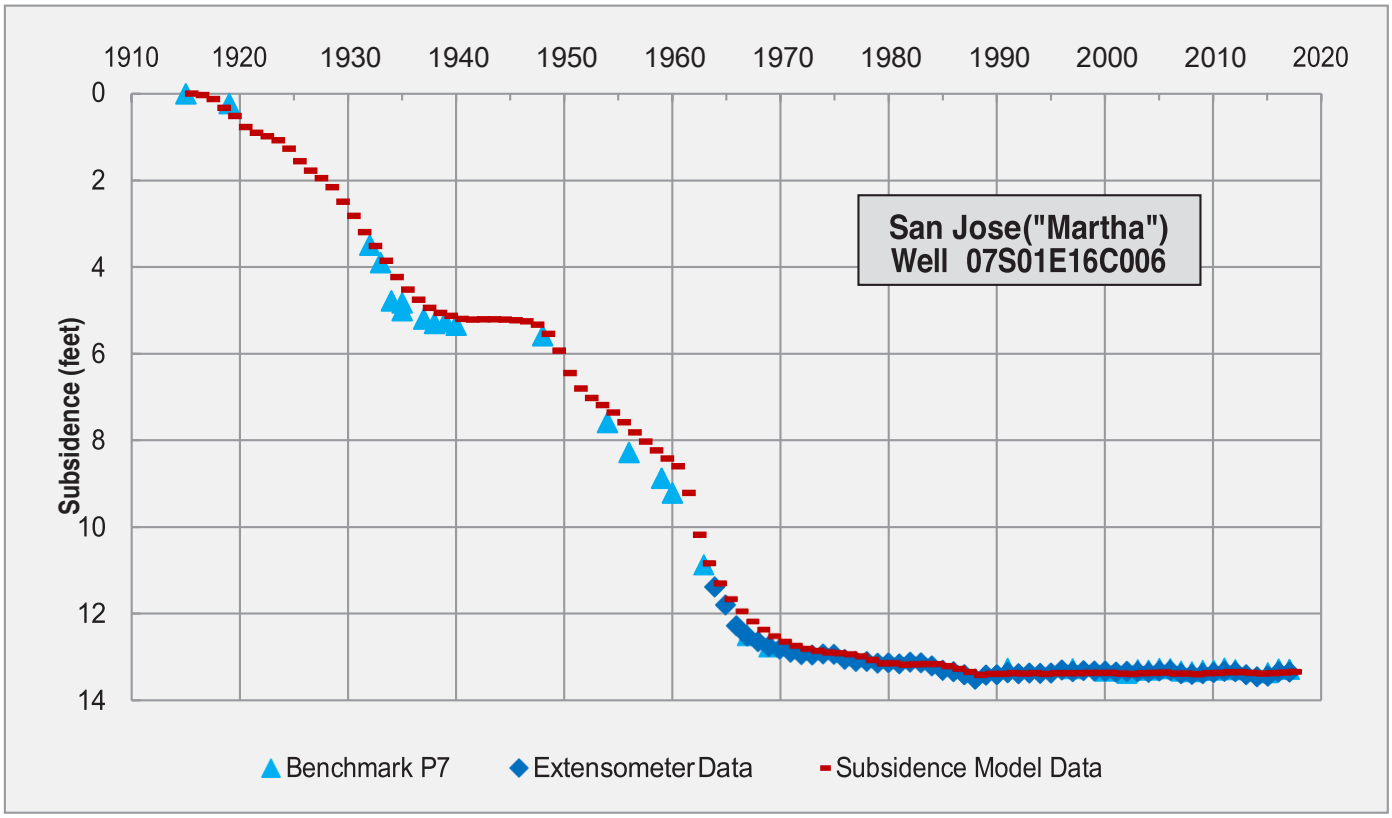
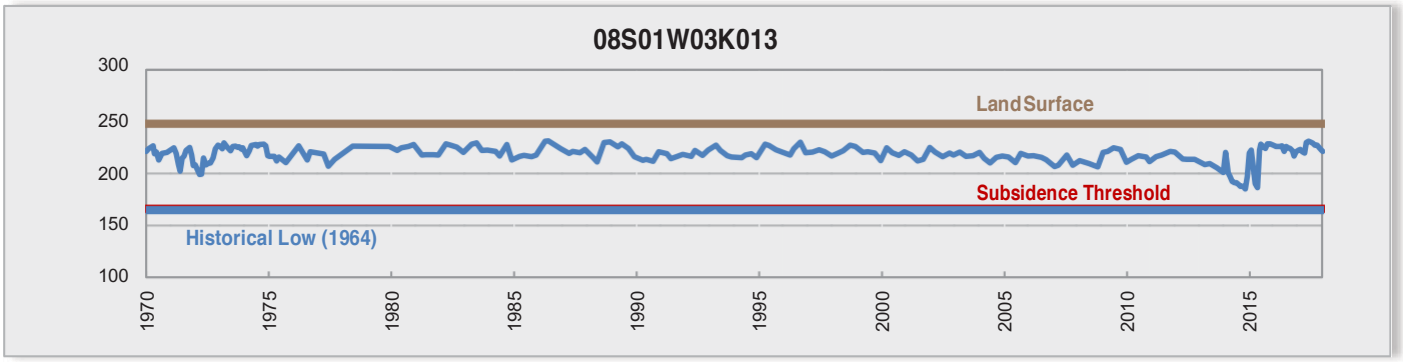
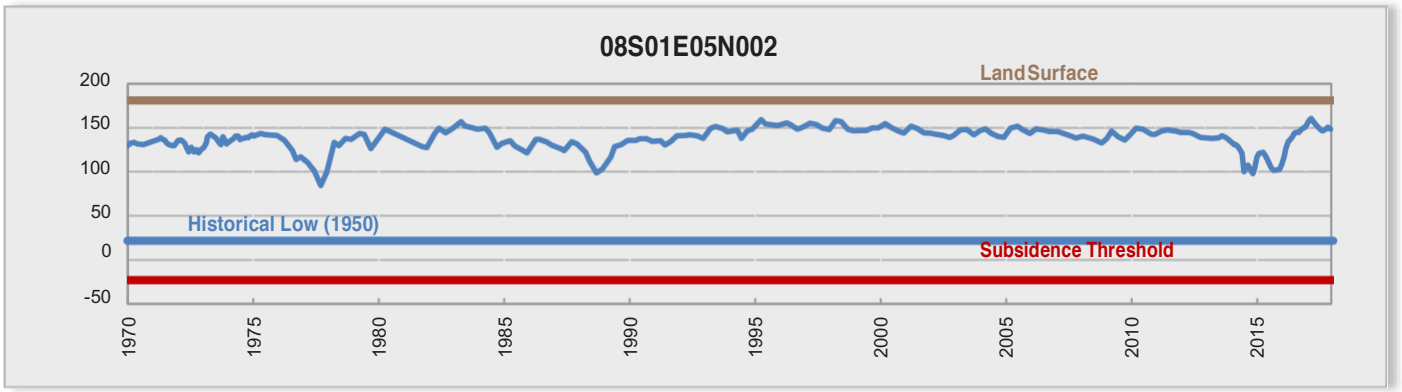
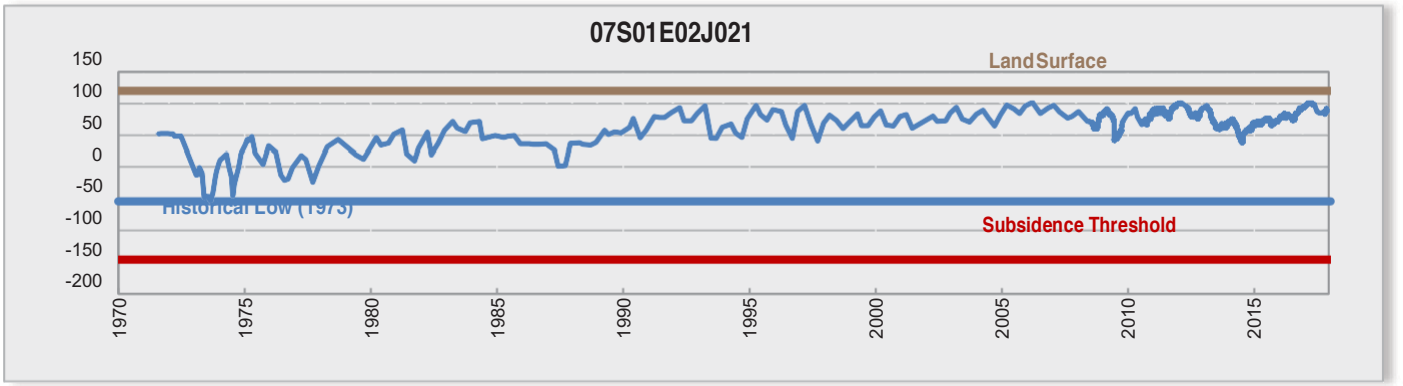


Figure 19. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NGVD29)







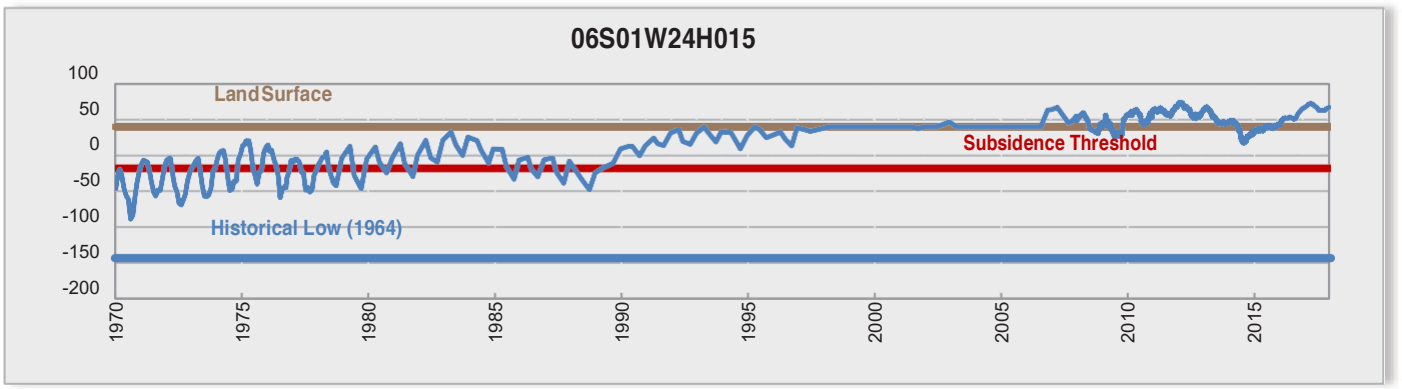
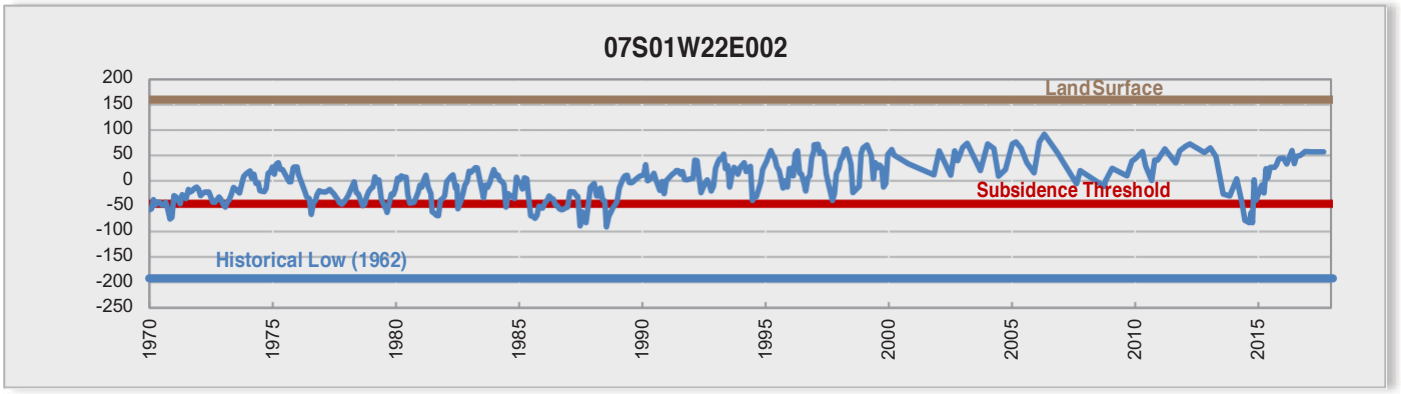
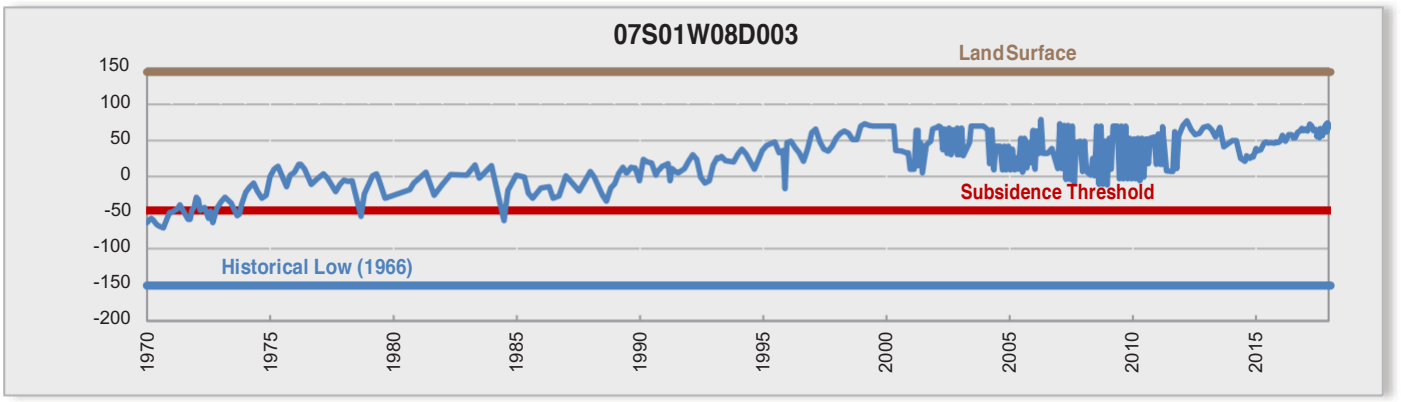
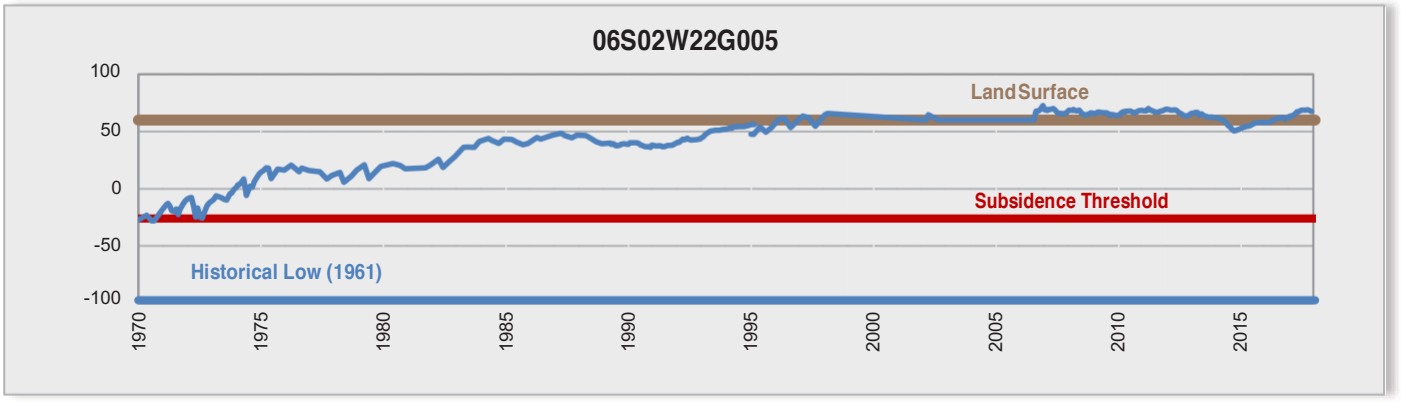


Figure 19. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NGVD29, continued)







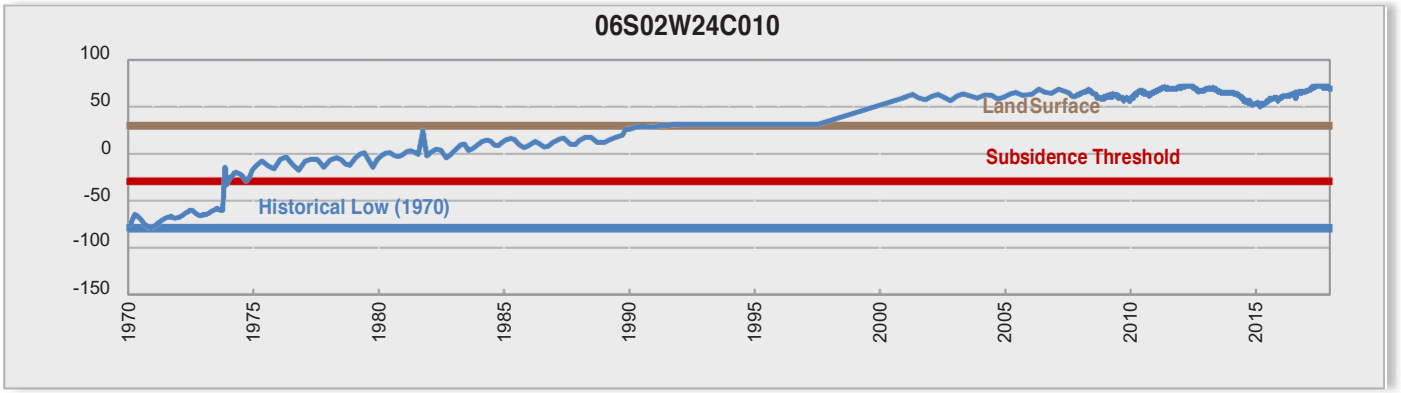
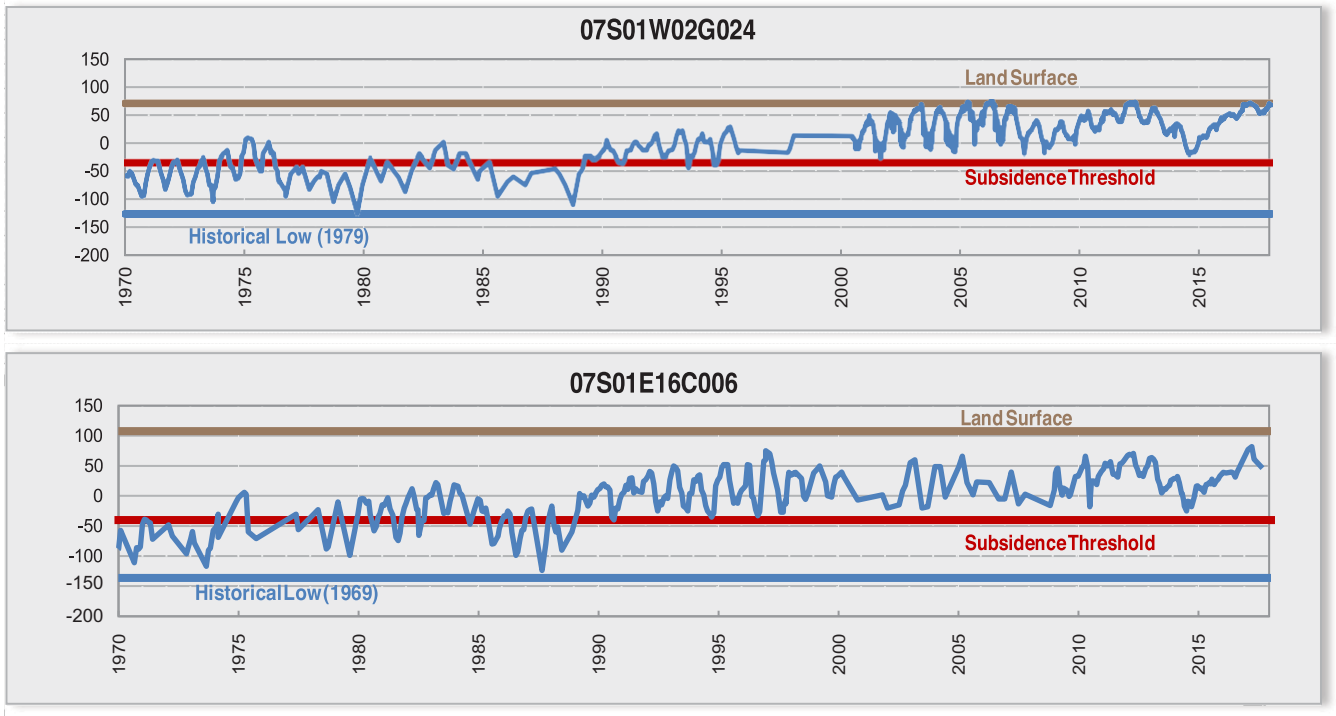


Figure 19. Groundwater Levels at Santa Clara Plain Subsidence Index Wells (feet, NGVD29, continued)



Land Subsidence Outcome Measure

OM 2.1.1.d.
100% of subsidence index wells with groundwater levels above subsidence thresholds.

The outcome measure was met for calendar year 2017 as groundwater levels were above subsidence thresholds at all ten Santa Clara Plain subsidence index wells.

CHAPTER 5 – GROUNDWATER QUALITY

In CY 2017, the District tested groundwater quality at 392 wells; 95 annual monitoring locations (both dedicated monitoring wells and domestic wells), 273 domestic wells, and 24 wells near recycled water irrigation sites. The District also analyzed groundwater quality data from 226 public water supply wells.[1] A summary of 2017 groundwater quality results for water supply wells is presented in Appendix B. Summary tables of sampled parameters with the median and range for each subbasin and aquifer zone[2] for all regional wells sampled are provided in Appendix C.

Water quality testing indicates groundwater in the Santa Clara and Llagas Subbasins is generally of good quality that meets drinking water standards in most wells for all constituents tested. The exception is nitrate, which was found above regulatory standards in 30% of the South County water supply wells sampled (primarily domestic wells) due to current and historic sources. The District continues to implement Salt and Nutrient Management Plans[3] to support reduced nitrate loading and exposure. The District offers eligible domestic wells owners free water testing for nitrate, as well as rebates for qualifying nitrate treatment systems.

In 2017, the District analyzed data from 24 monitoring wells near recycled water irrigation sites in the Santa Clara and the Llagas Subbasins. N-Nitrosodimethylamine (NDMA) and several perfluorinated compounds (PFCs) were detected in recycled water used for irrigation. Unlike some previous sampling events, NDMA was not detected in any wells. PFCs were detected in some shallow wells in the Santa Clara and the Llagas Subbasins. Most monitoring wells demonstrated stable or decreasing trends for key water quality indicators, suggesting that groundwater is not significantly affected by recycled water use. A summary of related results is presented in Appendix D.

The District is currently evaluating the program to sample recharge water quality and did not conduct any related sampling during 2017. The District continues to coordinate with local, state, and federal agencies managing cleanup of groundwater contamination sites by tracking progress on high-priority sites and issuing recommendations for effective remediation. The District will continue to track water quality changes and work with stakeholders to identify ways to protect groundwater quality.

5.1 Regional Groundwater Quality

The District sampled groundwater quality at 95 long-term monitoring wells sampled annually, including 69 monitoring wells and 26 domestic wells (Figure 20). Seventy-nine samples were analyzed for almost 50 water quality parameters including major and minor ions, nutrients, and trace metals. Analysis of volatile organic compounds is conducted every three years and is next scheduled for 2018. Water from 16 shallow monitoring wells near the San Francisco Bay, used for salt water intrusion monitoring, were analyzed for ions and metals only. The regional groundwater quality

evaluation also incorporates limited data from 53 wells with known construction attributes sampled through the District's voluntary domestic well sampling program and data from 226 public water supply wells sampled by public

[1] Data for public water systems is available from the State Water Resources Control Board Division of Drinking Water website.
[2] Public water supply wells were assumed to represent the principal aquifer if no construction information was available, as these are typically deep wells.
[3] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies

water systems and reported to the State Water Resources Control Board Division of Drinking Water (DDW) .

To evaluate regional water quality conditions, water quality test results are compared to state and federal water quality standards. A summary table of sampled parameters showing the median and range for each subbasin and aquifer zone[4] is provided in Appendix C. Results indicate that groundwater in the Santa Clara and Llagas subbasins is generally of high quality. Water quality indicators, ions, and trace elements were within the normal range expected in groundwater, except for nitrate. Elevated nitrate concentrations are primarily an issue in South County due to historic and ongoing sources including synthetic fertilizer, septic systems, and animal enclosures.

Recent sample median concentrations for nitrate and Total Dissolved Solids (TDS) are presented in Table 7. The median concentration for nitrate ranges from 1.5 mg/L in the Santa Clara Plain shallow aquifer to 10 mg/L in the Llagas Subbasin shallow aquifer. The median TDS concentration ranges from 370 in the Llagas Subbasin principal aquifer to 438 mg/L in the Santa Clara Plain shallow aquifer. Although 2017 nitrate median concentrations appear generally higher (particularly for the Coyote Valley and Llagas Subbasin) and TDS values appear lower than 2016, there is no statistically significant difference between these results per the Mann-Whitney Test, using a 95% confidence level. Fluctuations in sample medians are expected due to variation in which wells are tested each year, the quantity of wells tested per year, amounts of recharge, pumping, and rainfall. The District will continue to closely monitor groundwater quality conditions and trends and take action as needed.

Thirteen individual volatile organic compounds (VOCs), which include disinfection byproducts, were detected in groundwater in 2017, as summarized and listed by subbasin in Table C-4. However, none of the compounds detected was present above its respective Maximum Contaminant Level (MCL) and maximum concentrations were typically well below the MCL. The exception is for 1,1-dichloroethene, which was detected in a monitoring well at 6.8 micrograms per liter (ug/L) in the Santa Clara Plain principal zone aquifer; the related MCL is 6 ug/L. The maximum concentration of 1,1-dichloroethene in a water supply well was 0.87 ug/L. VOCs occur primarily from industrial use of solvents and from leaking underground fuel tanks. Pesticide compounds were not detected above the MCL in the Santa Clara Plain, Coyote Valley or the Llagas Subbasin.

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[4] Public water supply wells were assumed to represent the principal aquifer if no construction information was available, as these are typically deep wells.

Figure 20. CY 2017 Groundwater Quality Monitoring Wells

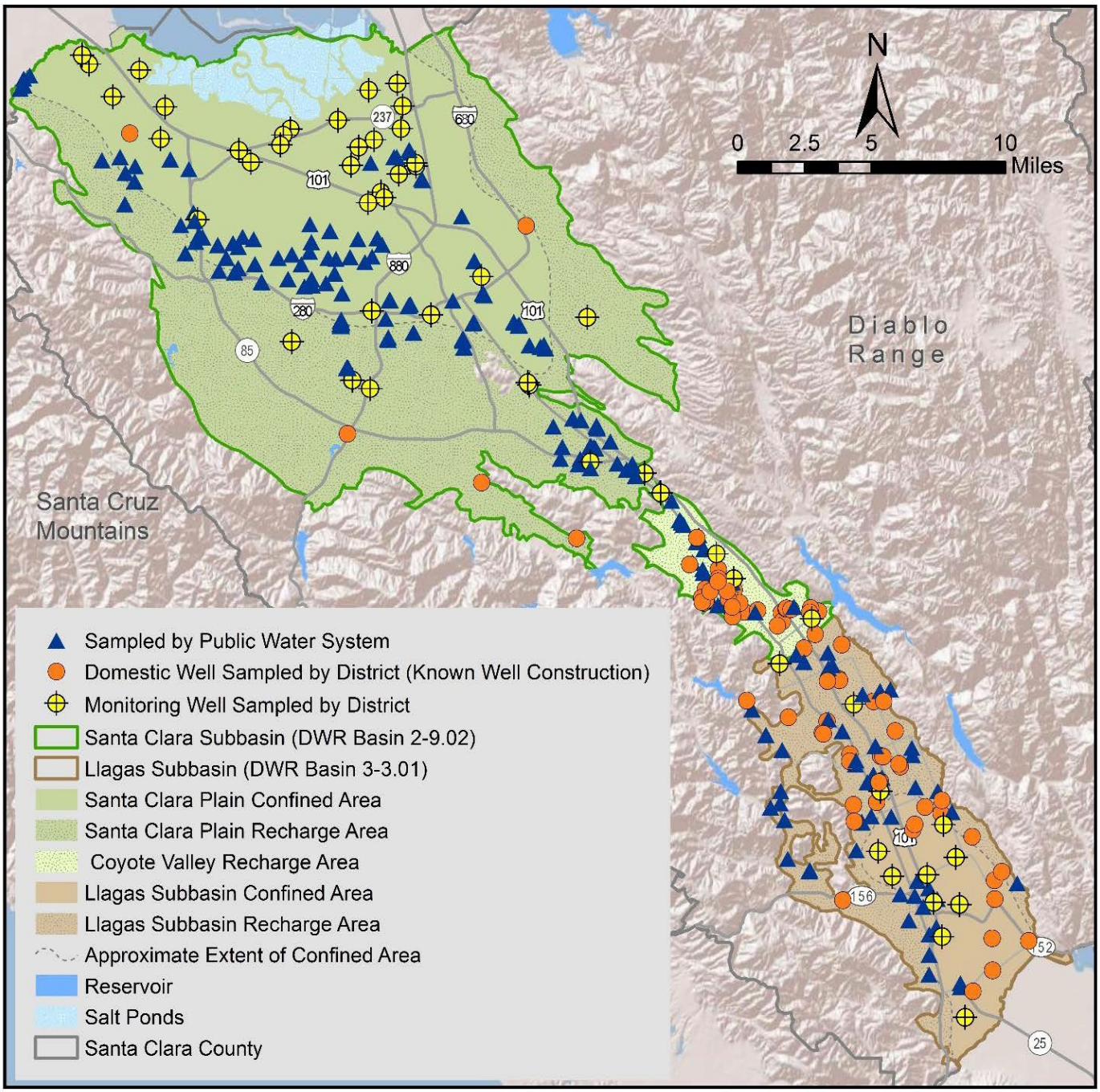


Table 7. Median Nitrate and TDS by Subbasin and Aquifer Zone (mg/L)

Parameter	Santa Clara Subbasin						Llagas Subbasin			
	Shallow Aquifer		Principal Aquifer		Coyote Valley		Shallow Aquifer		Principal Aquifer	
	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016
Nitrate as N	1.50	1.10	3.06	3.00	7.20	4.85	10	7.20	5.20	4.50
TDS	438	498	390	410	372	376	388	400	370	419

Notes:

1. The shallow and principal aquifer zones are represented by wells primarily drawing water from depths less than and greater than 150 feet below ground surface, respectively.
2. Nitrate as N has a health-based MCL of 10 mg/L. TDS has an aesthetic-based MCL, which ranges from 500 to 1,000 mg/L (recommended and upper limit, respectively).
3. Table 7 includes information for monitoring wells, public water supply wells, and domestic wells for which construction information is available. The set of wells sampled each year varies.
4. Median TDS in the Santa Clara Plain Shallow aquifer excludes certain wells within the region influenced by salt water interaction.

Comparison to Drinking Water Standards

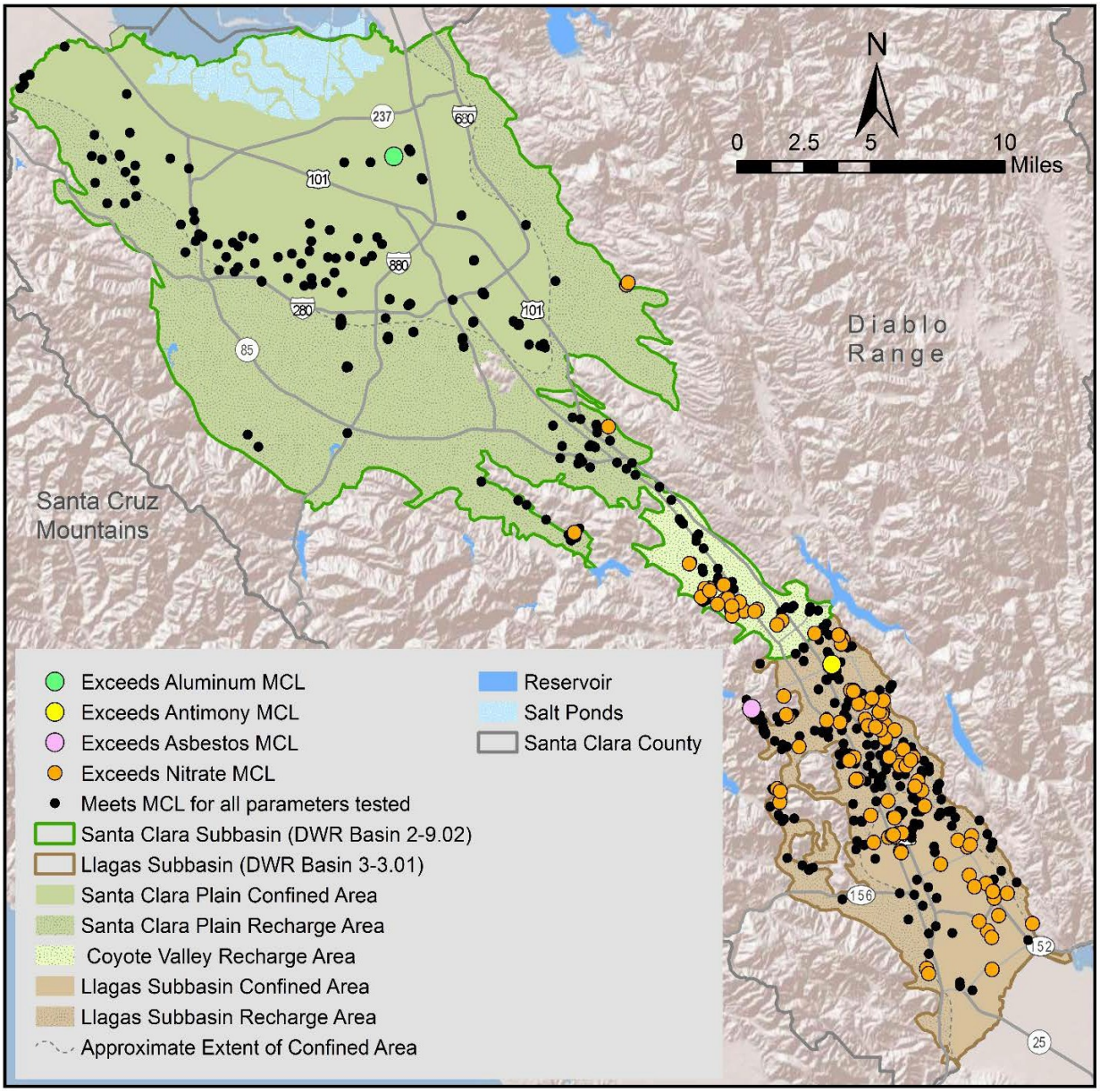
Except for nitrate, and to a limited extent aluminum, asbestos and antimony, all water supply wells tested (public water supply wells and private domestic wells) met all MCLs. Figure 21 presents the locations of water supply wells with an MCL exceedance.[5] For public water supply wells, 98% met all MCLs, while 81% of all domestic wells met MCLs for the parameters tested (typically fewer parameters compared to public wells). Aluminum and antimony are naturally occurring substances that are occasionally observed exceeding their standard. Asbestos is also naturally occurring; the only exceedances that have been observed, including the detection in 2017, have been from a single well in the Llagas Subbasin. The detections of these three contaminants is not indicate a widespread concern.

The nitrate MCL (10 mg/L) is met for 79% of all water supply wells countywide. 30% of South County water supply wells tested exceeded the nitrate MCL; this breaks down to 9% of South County public water supply wells and 35% of domestic wells having exceeded the nitrate MCL. Most of these detections were from private domestic wells that are not regulated by the state, while 8.4% (9 wells) were public water systems. Public water systems must comply with drinking water standards, which may require treatment or blending prior to customer delivery. Based on communication with well owners participating in District sampling programs, many domestic well owners use bottled water for drinking and cooking, or reverse osmosis treatment to reduce nitrate.

[5] For data obtained from the DDW website, any result reported above an MCL is considered an exceedance for the purposes of this report. Based on DDW regulations and follow-up sampling, a single detection above an MCL may not constitute a violation of a drinking water standard.

While not used as a source of drinking water, some monitoring wells sampled are screened in the principal aquifer zone. Two deep monitoring wells sampled in 2017 had detections above their respective MCLs; one for nitrate (Llagas Subbasin) and one for 1,1-dichloroethene (Santa Clara Subbasin). Seven shallow aquifer zone monitoring wells in the Llagas Subbasin had elevated nitrate. Shallow groundwater quality is important, even though it is generally not used as a source of drinking water, because it is a potential water supply source and because shallow groundwater recharges the principal aquifer in recharge areas.

Figure 21. CY 2017 Water Supply Well Results: MCL Exceedances



Unregulated Contaminant Monitoring

The U.S. Environmental Protection Agency (EPA) has developed a systematic process for evaluating whether individual chemicals should be regulated to ensure that drinking water poses no significant risk to the public. Every 5 years, the EPA develops a list of compounds to be analyzed for in large public drinking water systems through the Unregulated Contaminant Monitoring Rule (UCMR). The EPA uses the UCMR to collect data for contaminants that are suspected to be present in drinking water and do not have health-based standards set under the Safe Drinking Water Act. The EPA has completed three rounds of UCMR: UCMR 1 with monitoring between 2001 and 2003, UCMR 2 with monitoring between 2008 and 2010, and UCMR 3 with monitoring between 2013 and 2015. UCMR 3 results for groundwater in Santa Clara County (sampled by water retailers) were summarized in the District's Annual Groundwater Report for 2016. UCMR 4 monitoring will occur between 2018 and 2020 and includes a total of 30 contaminants including cyanotoxins, metals, pesticides and related byproducts, disinfection byproducts, alcohols, and semi-volatile organic chemicals. UCMR 4 sampling results will be presented upon sampling completion and availability through the EPA.

Comparison to Agricultural Objectives

Agriculture in Santa Clara County is largely limited to the Coyote Valley and Llagas Subbasin. South County groundwater quality was evaluated against agricultural water quality objectives from the applicable Regional Water Quality Control Board Basin Plans[6] to assess its suitability. Because the District has limited access to agricultural wells, water supply well data was used in this evaluation. Ninety-seven percent of all South County water supply wells met Basin Plan agricultural objectives. In Coyote Valley, all wells met agricultural objectives except one well for nitrate. In the Llagas Subbasin, nine wells did not meet agricultural limits for sodium (one well), nitrate (six wells), manganese (one well), or fluoride (one well).

5.2 Groundwater Quality Trends

To assess changes in water quality over time, the District evaluated statistical trends for chloride, nitrate, and TDS concentrations by groundwater management area and aquifer zone. Concentration trends were evaluated for all wells sampled in 2017 that had at least five results over the last 15 years (2003 through 2017). The results show that most wells have stable or decreasing concentration trends for chloride, nitrate, and TDS (Figures 22 through 24 and Table 8). In general, chloride concentration trends are stable (83%) or increasing (17%) in the Llagas Subbasin, stable in Coyote Valley and mixed in the Santa Clara Plain. Nitrate concentrations are generally stable or decreasing throughout the county, indicating favorable trends although high concentrations remain in some wells. A group of wells with decreasing nitrate concentrations is observed in the southern portion of the Santa Clara Plain near the Coyote Valley (Figure 23). This may be the result of dilution from the managed recharge of water with low nitrate content through Coyote Creek. Though less well-defined, another group of wells with an upward nitrate concentration trend is in the

downtown area of San Jose. This is likely due to remnant concentrations of nitrate from historic agricultural land use in the area. Only a small percentage of countywide wells analyzed had increasing concentrations of TDS (6%). Increasing

[6] Groundwater in the Coyote Valley is compared to the limits in Table 3-6 of the San Francisco Bay Basin Water Quality Control Plan (March 2015). Groundwater in the Llagas Subbasin is compared to the upper range of the "increasing problems" range in Table 3-3 and Table 3-4 (irrigation supply) of the Water Quality Control Plan for the Central Coast Basin (March 2016).

TDS concentrations were indicated in the Coyote Valley and the Llagas Subbasin shallow aquifer wells, in 11% (2 wells) and 19% (4 wells), respectively. These trends will continue to be monitored; however, it should be noted that there are few monitoring wells in each of these areas so a change in trend in one well represents a large percentage.

Table 8. Chloride, Nitrate, and TDS Concentration Trends (2003 - 2017)

Groundwater Management Area	Parameter	Number of Wells Evaluated	Percent of Wells with Stable Trend	Percent of Wells with Decreasing Trend	Percent of Wells with Increasing Trend
Santa Clara Plain Shallow Aquifer	Chloride	24	54%	4%	42%
	Nitrate (as N)	16	88%	12%	0%
	TDS	22	82%	14%	4%
Santa Clara Plain Principal Aquifer	Chloride	115	86%	3%	11%
	Nitrate (as N)	228	66%	23%	11%
	TDS	115	94%	1%	5%
Coyote Valley	Chloride	17	94%	0%	6%
	Nitrate (as N)	26	54%	35%	11%
	TDS	18	89%	0%	11%
Llagas Subbasin Shallow Aquifer	Chloride	21	57%	0%	43%
	Nitrate (as N)	23	91%	4.5%	4.5%
	TDS	21	81%	0%	19%
Llagas Subbasin Principal Aquifer	Chloride	48	83%	0%	17%
	Nitrate (as N)	79	68%	23%	9%
	TDS	48	96%	2%	2%
All Groundwater Management Areas	Chloride	225	80%	2%	18%
	Nitrate (as N)	372	68%	23%	9%
	TDS	224	92%	2%	6%

Figure 22. Chloride Concentration Trends (2003 - 2017)

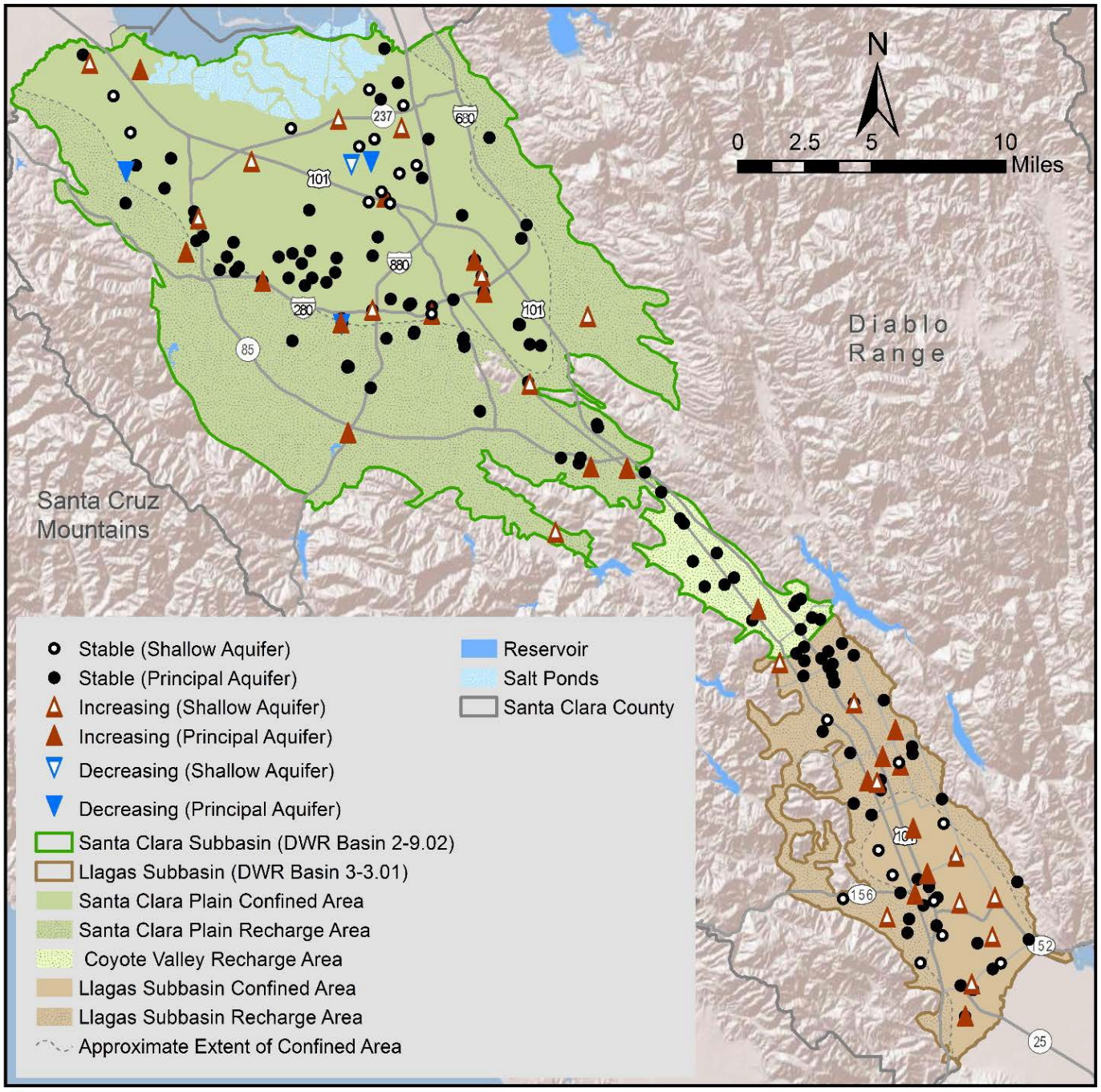


Figure 23. Nitrate Concentration Trends (2003 - 2017)

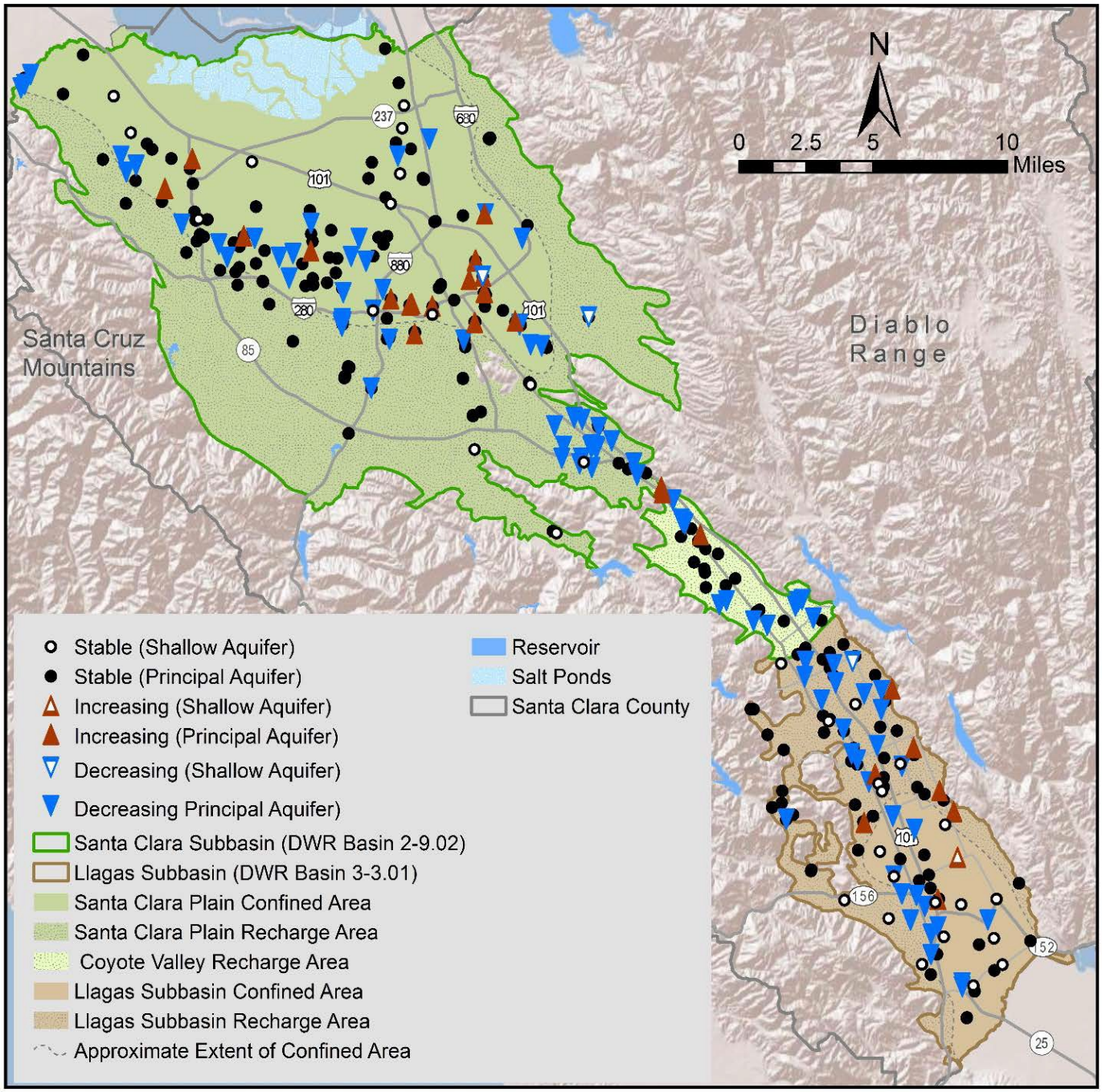
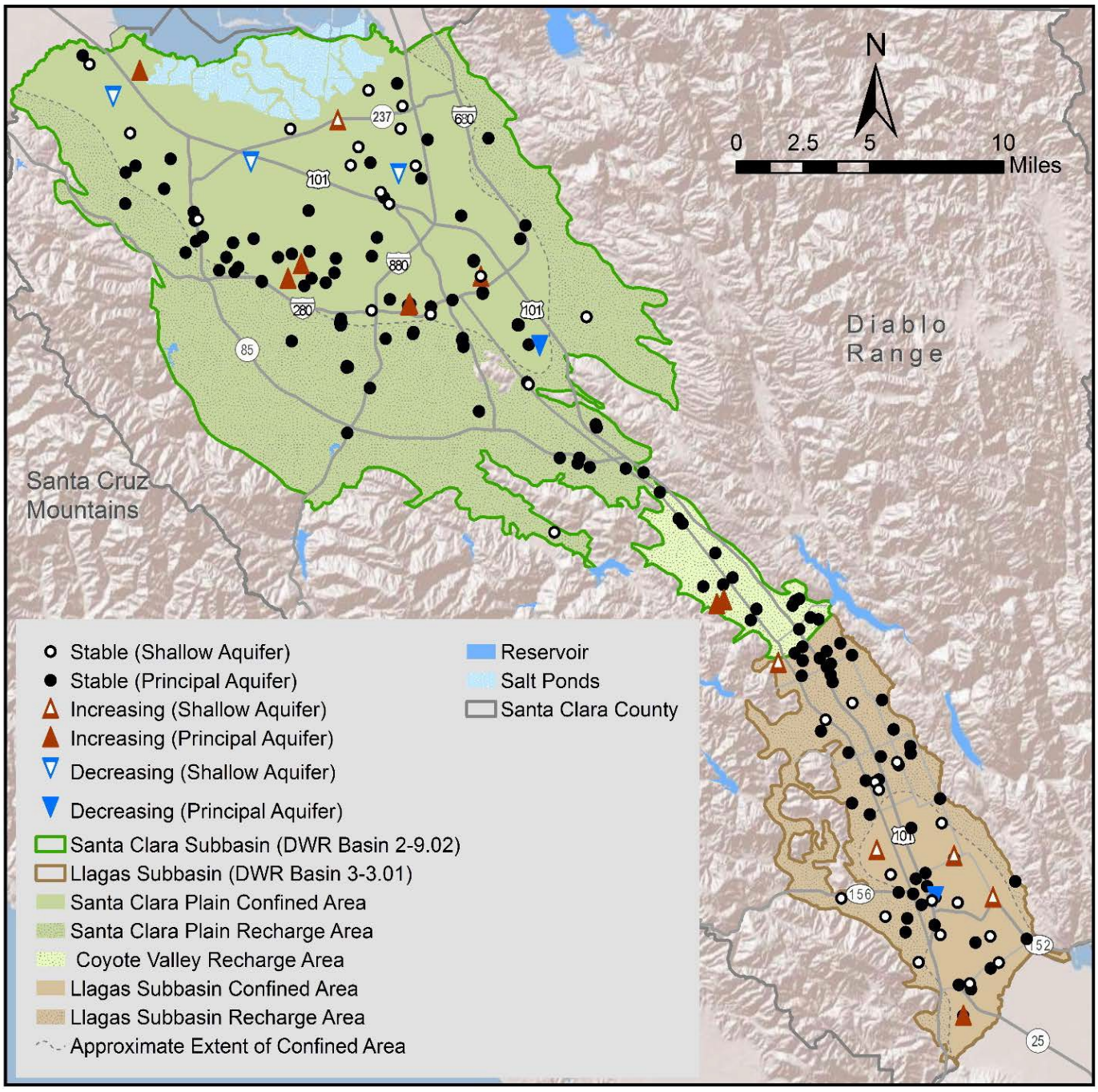


Figure 24. Total Dissolved Solids (TDS) Concentration Trends (2003 - 2017)



The District also conducted a 5-year and 10-year statistical step trend analysis for nitrate and TDS median concentrations by groundwater management area and aquifer zone. This analysis was not completed for chloride, which would likely be represented by the TDS results. The results show that there is no significant change in 2017 nitrate and TDS concentrations when compared to median concentrations from 5 and 10 years prior (2012 and 2007, respectively) per the Mann Whitney test with a 95% confidence level and assuming individual data sets per each step trend (Table 9). The exception is in the Santa Clara Plain principal aquifer, which shows a decrease of 1 mg/L in TDS median concentrations when compared to concentrations from 10 years ago. Overall, nitrate and TDS median groundwater concentrations remain stable across the Santa Clara and Llagas subbasins.

Table 9. Total Dissolved Solids and Nitrate Step Trends[1]

	2017	5-Year Step Trend[2]	10-Year Step Trend
Total Dissolved Solids (TDS, mg/L)			
Santa Clara Plain	390	No Change	Decrease (~ 1 mg/L)
Coyote Valley	372	No Change	No Change
Llagas Subbasin	370	No Change	No Change
Nitrate (as Nitrogen, mg/L)			
Santa Clara Plain	3.06	No Change	No Change
Coyote Valley	7.2	No Change	No Change
Llagas Subbasin	5.2	No Change	No Change

Notes:

1. Values represent the median groundwater concentration for principal aquifer zone wells tested (both water supply wells and monitoring wells).
2. The median 2017 concentration for each groundwater management area was compared to that of 5 years ago (2012) and 10 years ago (2007) to determine if there is any statistically significant difference using the Mann-Whitney test at the 95% confidence level.

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Groundwater and Salt Water Interaction

Salt water intrusion into shallow aquifers was observed historically near South San Francisco Bay and adjacent to the tidal reaches of the Guadalupe River, Coyote Creek, and other creeks in the northern portion of the Santa Clara Plain. As previously discussed, the District has implemented managed recharge and in-lieu recharge programs to minimize the risk of groundwater overdraft, land subsidence, and salt water intrusion.

Chloride concentrations from shallow monitoring wells are used to assess groundwater and salt water interaction adjacent to southern San Francisco Bay and near tidal reaches of creeks. The District uses a chloride concentration of 100 mg/L as a threshold to indicate that salt water is impacting groundwater. This is a conservative approach since the aesthetic-based secondary MCL for chloride is 250 mg/L.

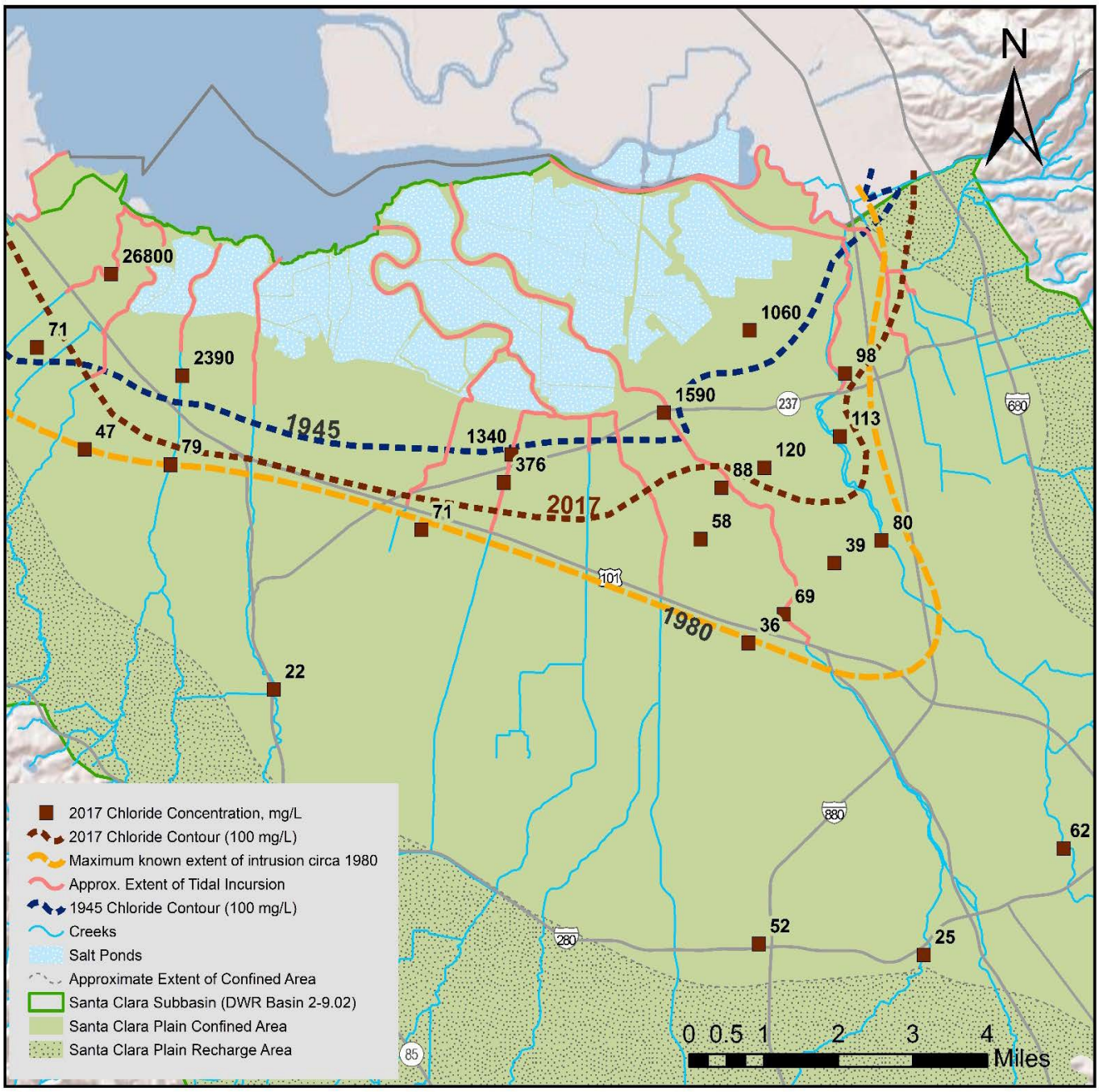
As shown on Figure 25, wells with chloride over 100 mg/L are in a narrow band near the former salt evaporation ponds, except in the areas adjacent to the tidal reaches of creeks (e.g., lower extent of the Guadalupe River and Coyote Creek). In these creek areas, a larger portion of the shallow aquifer is affected due to tidal incursion in these channels that occurs due to historic land subsidence, represented by the 1980 contour. A significant increase in chloride content is observed near the western edge of the salt evaporation ponds. However, most shallow wells in this area have downward long-term concentration trends for chloride, demonstrating that the salt water intrusion front appears to be stable or retreating since 1980 due to improved groundwater conditions.

Historically, few wells in the principal aquifer zone were found to have elevated TDS or chloride concentrations. Salt water intrusion of the principal aquifer may occur from shallow saline groundwater via vertical conduits such as abandoned wells when the vertical hydraulic gradient is downward.[7] At isolated locations in Palo Alto and southeast San Jose, the source of elevated TDS in deeper wells has been characterized as connate water (trapped salt water from the geologic past), rather than recent salt water intrusion. The District currently conducts only limited monitoring of the principal aquifer in the Baylands area because few deeper wells are available. Migration of saline shallow groundwater into the principal aquifer has been prevented due to the District's managed and in-lieu recharge programs, which maintains artesian conditions (upward vertical gradient) in the Baylands area.[8] Tidal incursion in the bayward reaches of streams still occurs and continues to introduce saline water to the shallow aquifer, as observed in elevated chloride concentrations in shallow aquifer wells in the Baylands area.

[7] Vertical gradients in the Baylands area where salt water interaction occurs have been upward for the last 20 years (approximately).

[8] Artesian conditions are facilitated by the presence of a laterally-extensive clay layer (aquitard), which confines the pressure within the principal aquifer, and isolates the principal aquifer from saline intrusion and other contamination.

Figure 25. Groundwater and Salt Water Interaction in the Santa Clara Plain Shallow Aquifer



5.3 Domestic Well Water Quality

The District offers free, basic water quality testing to domestic well owners within the District's groundwater charge zones through the Domestic Well Testing (DWT) program. In 2017, the District tested 27 domestic wells in North County and 268 wells in South County. Parameters tested include nitrate, bacteria, electrical conductivity, and hardness. As described previously, the District's annual groundwater sampling also includes a number of domestic wells. This section summarizes 2017 data from all domestic wells sampled by the District. The wells sampled under the DWT program vary by year based on voluntary participation by well owners. North County testing included 8 new wells and 19 repeat wells, while South County included 205 new wells and 63 repeat samples.

Domestic well testing helps improve the District's understanding of the occurrence of common contaminants and helps private well owners understand their water quality, so they can make informed decisions. Although water quality in domestic wells is not regulated by the state, the comparison to state drinking water standards provides context for results. Table 10 summarizes the results for each charge zone, including median concentrations and percent of wells with concentrations above drinking water standards.

Nitrate was detected above the MCL at 15% of North County domestic wells tested and 35% of South County wells tested. The nitrate results are shown in Figure 26 relative to the MCL of 10 mg/L nitrate as nitrogen. The median concentration of nitrate (as nitrogen) in domestic wells in North and South County was 2.45 mg/L and 6.70 mg/L, respectively. The 2017 regional median nitrate concentrations for the principal aquifer in the Santa Clara Plain, Coyote Valley, and Llagas Subbasin are 3.06, 7.20, and 5.20 mg/L, respectively.

Countywide, total coliform bacteria were detected in about 35% of the domestic wells tested, a slightly higher percentage than in 2016 (32%). Coliform bacteria are naturally present in humans, animals, and the environment and do not normally cause illness, but they should not be present in drinking water. Escherichia coli (E. coli), a type of coliform bacteria indicative of fecal contamination, were detected in about 3% of the domestic well systems tested countywide. Total coliform and E. coli detections appear randomly distributed, but more frequent in the Llagas Subbasin.

The continued presence of nitrate above the MCL in many domestic wells highlights the need for ongoing efforts by regulatory and land use agencies, agricultural operators, and groundwater management agencies to address elevated nitrate in groundwater. To reduce well owners' exposure to nitrate, the District implemented a multi-year rebate program for nitrate treatment systems in the fall of 2013, funded by the District's Safe, Clean Water and Natural Flood Protection Program (Measure B, a countywide special parcel tax). In 2017, the District issued eight nitrate treatment

system rebates. This effort complements outreach and other efforts to reduce nitrate loading in coordination with the Central Coast Water Board and other basin stakeholders.

Figure 26. Nitrate Results for 2017 Domestic Wells

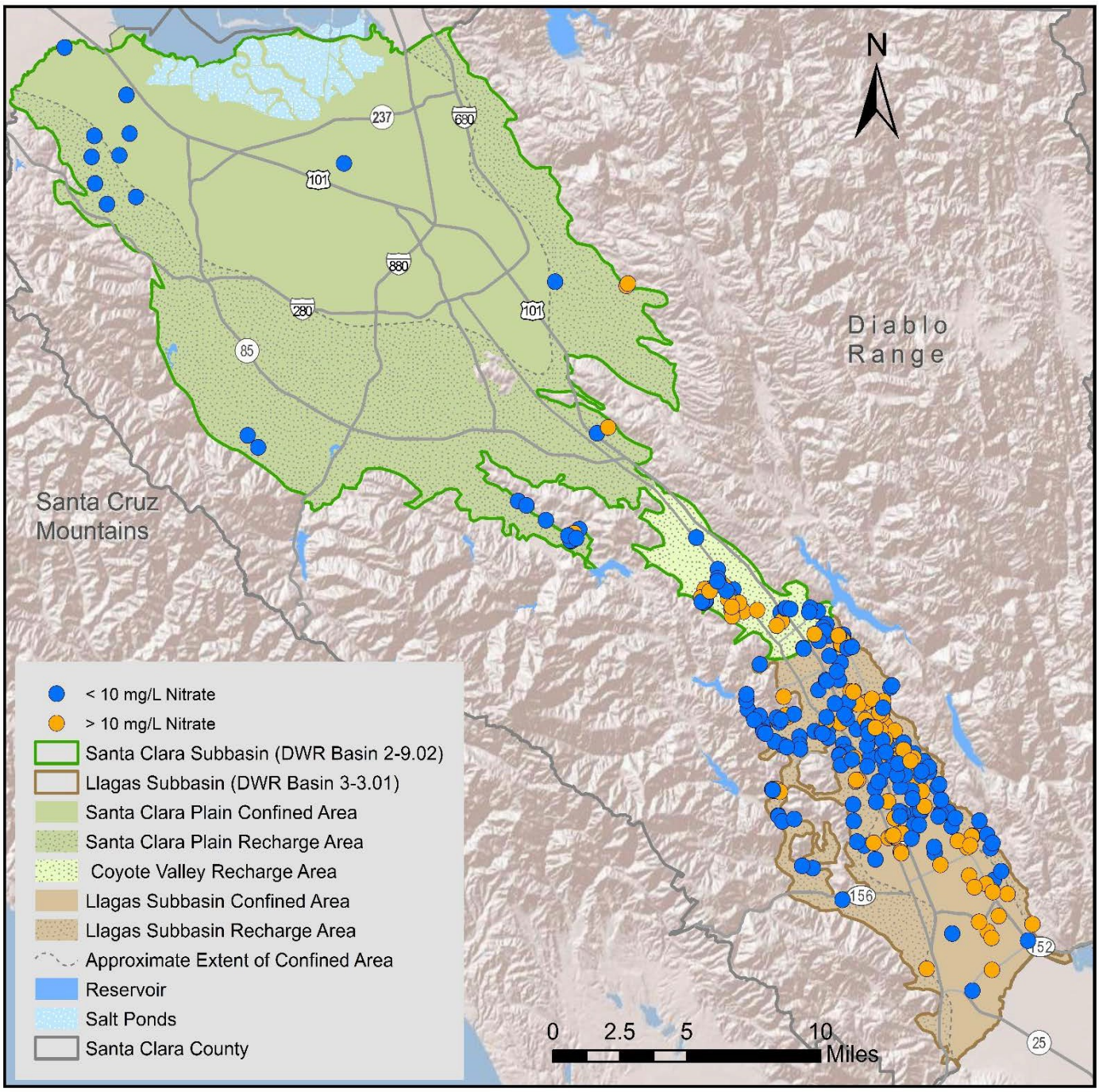


Table 10. CY 2017 Domestic Well Testing Results

Parameter and Units	MCL[1]	Zone W-2 North County		Zone W-5 South County	
		Median	Wells above MCL[1] (%)	Median	Wells above MCL[1] (%)
Nitrate as N (mg/L)	10 (P)	2.45	15%	6.70	35%
Fluoride (mg/L)	2 (P)	0.165	0%	0.150	0%
Electrical Conductivity (uS/cm)	900 (S)	719	33%	675	21%
Sulfate (mg/L)	250 (S)	47.3	0%	37.6	0%
Hardness (mg/L as CaCO3)	--	306	--	272	--
		Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)	Wells with Bacteria Present (No.)	Wells with Bacteria Present (%)
Total Coliform Bacteria	--[2]	11	41%	91	34%
E. Coli Bacteria	--[2]	4	15%	5	2%

Notes:

1) Maximum contaminant levels are established by the DDW for public water systems. (P) indicates the parameter has a health-based Primary MCL and (S) indicates a Secondary, aesthetic-based MCL. Hardness does not have a primary or secondary MCL but water with hardness above 180 mg/L is classified as very hard. Water quality in domestic wells is not regulated by the state.

2) Bacteria are measured as present or absent. Public water systems are required to ensure that fewer than 5% of samples have total coliform present and that no samples have E. Coli present.

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5.4 Recharge Water Quality

The District began monitoring surface water quality in 2006 at selected in-stream and off-stream recharge facilities to characterize recharge water quality and assess how managed recharge influences groundwater quality. Per the District's Groundwater Management Plan, each of the seven major recharge systems is to be sampled every three years. Analysis includes major and minor ions, trace elements, metals, organic compounds, and field data (e.g. temperature, dissolved oxygen).

In 2017, rather than conducting recharge water quality sampling, the District began evaluating the program to re-assess the monitoring locations, frequency, and parameters monitored. This started with the analysis of all recharge water quality monitoring data. Similar to previous summaries in annual reports, a review of all data suggests that recharge water quality is generally good and is typically similar to or better than the underlying groundwater quality. Although managed recharge water is not suitable for direct consumption before treatment or infiltration, comparing it to health-based drinking water standards provides context for results. No parameters were detected above these standards in any recharge water samples collected since 2006. After completing the comprehensive program analysis, the District will summarize the findings or program changes in the next Annual Report, in addition to any related data collected.

5.5 Monitoring Near Recycled Water Irrigation Sites

The District partners with the four recycled water producers in the county[9] to provide recycled water for non-potable purposes like landscape and agricultural irrigation, and industrial processes. Tertiary treated recycled water generally has higher concentrations of salts, nutrients, disinfection byproducts, and emerging contaminants than local groundwater or potable treated water.[10] Previous studies near recycled water irrigation sites, including the District study discussed below, have shown that contaminants migrate to shallow groundwater when turf and other landscaping is irrigated with tertiary treated recycled water.[11] Accordingly, the District conducts groundwater monitoring at twenty-four wells near recycled water irrigation sites and obtains groundwater monitoring data from South Bay Water Recycling (SBWR), a recycled water producer in San Jose.

In 2011, the District completed the Recycled Water Irrigation and Groundwater (RWIG) Study,[12] which included a field study at a recycled water irrigation site, the Integrated Device Technology (IDT) campus in southeast San Jose. The RWIG study and subsequent monitoring at IDT found that groundwater concentrations of most constituents of concern

[9] Recycled water is produced at the Palo Alto Regional Water Quality Control Plant, San Jose/Santa Clara Water Pollution Control Plant

(WPCP), the Sunnyvale WPCP and the South County Regional Wastewater Authority (SCRWA).

[10] Advanced Recycled Water Treatment Feasibility Project, Black & Veatch, Kennedy/Jenks for the Santa Clara Valley Water District, August 2003. In the Llagas subbasin, nutrient content of recycled water is lower than ambient groundwater concentrations (Llagas Subbasin Salt and Nutrient Management Plan).

[11] California GAMA Program: Fate and Transport of Wastewater Indicators: Results from Ambient Groundwater and from Groundwater Directly Influenced by Wastewater, Lawrence Livermore National Laboratory and California State Water Resources Control Board, June 2006.

[12] Locus Technologies for Santa Clara Valley Water District, Recycled Water Irrigation and Groundwater Study, Santa Clara and Llagas Groundwater Subbasins, Santa Clara County, California, August 2011.

did not increase after recycled water irrigation; however, chloride and TDS increased in one monitoring well. Several parameters indicative of recycled water were detected in shallow groundwater at IDT including PFCs, NDMA, and three other nitrosamine compounds. The RWIG study suggested that best management practices and changes in recycled water treatment may be warranted for irrigation with recycled water in sensitive areas.

The District and SBWR have worked to improve recycled water quality for irrigation and other uses. Since March 2014, recycled water provided by SBWR has been blended with advanced treated water from the District's Silicon Valley Advanced Water Purification Center (SVAWPC), which produces up to eight million gallons of water a day using microfiltration, reverse osmosis, and ultraviolet light. The final blended recycled water has better water quality, with TDS lowered from about 750 mg/L to about 500 mg/L.

To determine the impacts to groundwater from recycled water irrigation, the District monitors groundwater quality changes near selected recycled water irrigation sites as shown in Figures 27 and 28. In addition, SBWR collects annual samples at up to 13 (seven in CY 2017) wells in the Santa Clara Plain as part of the City of San Jose's Groundwater Monitoring and Mitigation Program (GMMP). Table 11 provides a summary of groundwater monitoring near recycled water sites in 2017.

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Table 11. Summary of 2017 Groundwater Monitoring near Recycled Water Irrigation Sites

Subbasin	Location	Sampling Agency	Sampling Summary
Santa Clara Subbasin (Santa Clara Plain)	Integrated Device Technology (IDT) Campus, Edenvale area of San Jose	IDT and District	• Groundwater from four shallow wells was sampled in February 2017 • Recycled water delivered to this site was sampled in February 2017
	Various Locations in San Jose	South Bay Water Recycling	• Groundwater from five shallow wells and two deep wells was monitored in March 2017 by the City of San Jose per their Groundwater Mitigation and Monitoring Plan (GMMP)
Llagas Subbasin	Christmas Hill Park, Gilroy	District	• Groundwater from four shallow wells was sampled for three quarters • Recycled water delivered to this site was sampled for the same three quarters as groundwater
	Irrigated Land Near SCRWA Plant, Gilroy	District	• Groundwater from three shallow wells and one deep well was sampled for two or three quarters (depending on the well) • The effluent water from the SCRWA recycled water treatment facility was sampled for two quarters in 2017
	Irrigated Land Along Expanded Recycled Water Pipelines (West Gilroy)	District	• Groundwater from 12 shallow monitoring wells was sampled for a minimum of two or three quarters (depending on the well)

The District evaluates the Santa Clara Plain groundwater data from SBWR and the District sites in both the Santa Clara Plain and the Llagas Subbasin. Statistical analysis of concentration trends and other geochemical analytical methods are used to evaluate water quality changes as summarized below for each subbasin.

Santa Clara Subbasin

As shown in Figure 27, both the SBWR and the District monitor for the effects of recycled water irrigation on groundwater in the Santa Clara Plain (there is no recycled water irrigation in the Coyote Valley). The parameters analyzed by SBWR include basic salts and minerals, alkalinity and TDS. The District analyzes the IDT well samples for basic water quality parameters, ions, disinfection byproducts (DBPs), PFCs, NDMA, bacterial parameters, and other constituents commonly encountered in recycled water.

Integrated Device Technology Site

For the first time since 2014, groundwater samples were taken from all four IDT wells (the wells had been dry due to the drought in 2015 and 2016). To provide continued information on the quality of recycled water used onsite, the

District also analyzed recycled water source samples from the onsite irrigation system (recycled water produced by SBWR).

In 2017, NDMA was detected in IDT irrigation water at 380 nanograms per liter (ng/L). This value is within the range observed in IDT source water (200 ng/L to 680 ng/L from 2008 – 2017, with a median of 370 ng/L) but exceeds the notification level of 10 ng/L NDMA. IDT irrigation water is not used for drinking water supplies, nor is the shallow groundwater sampled at the site. NDMA can form during recycled water treatment and within pipelines.[13] In contrast to previous years, NDMA was not detected in any of the four IDT wells in the one sampling event in 2017. The maximum level detected in shallow groundwater at the site was 18 ng/L, in September 2013. A second type of nitrosamine, N-nitrosodiethylamine (NDEA), was detected in IDT irrigation water and in one of the IDT wells. Both detections were below the notification level of 10 ng/L for drinking water.

All three of the major PFCs, Perfluorobutanoic Acid (PFBA), Perfluorooctanoic Acid (PFOA), and Pefluorooctane Sulfonate (PFOS), were detected in IDT irrigation water. California does not have a public health goal or regulatory standard for any PFC in drinking water. In 2016, the EPA issued a health advisory recommending that the combined levels of PFOA and PFOS not exceed 70 ng/L in drinking water.[14] PFBA and PFOS were not detected in any of the IDT wells in 2017 (PFBA has never been detected in an IDT well). PFOA was detected in one of the IDT wells at 7.6 ng/L, below the EPA health advisory value.

The secondary MCL for TDS (500 mg/L) was slightly exceeded with a median value of 520 mg/L for the four IDT wells. All IDT wells have an ionic composition more like natural groundwater than recycled water. For all parameters analyzed, most wells demonstrate stable or decreasing concentration trends, suggesting that shallow groundwater at the IDT site is not changing significantly over time. However, the presence of emerging contaminants like PFCs and nitrosamines, which were not detected at IDT prior to recycled water irrigation, warrants continued monitoring.

South Bay Water Recycling Groundwater Monitoring and Mitigation Program Wells

The median TDS value for the SBWR GMMP wells measured in 2017 is 750 mg/L which exceeds the secondary MCL for TDS. Most wells have an ionic composition more like natural groundwater than recycled water; however, two wells have an ionic composition in between that of natural groundwater and recycled water, suggesting the influence of recycled water on groundwater quality. For all parameters, except for chloride and potassium, most wells demonstrate stable or decreasing concentration trends. With respect to chloride and potassium, approximately half the wells show increasing concentration trends most likely due to long-term recycled water use. Table 12 presents a summary of groundwater quality concentration trends at Santa Clara Subbasin sites where recycled water is used.

[13] Monochloramine, a disinfection byproduct, can react with certain forms of organic nitrogen that contains precursors to produce NDMA.

[14] US EPA, "Fact Sheet: PFOA and PFOS Drinking Water Advisories". https://www.epa.gov/sites/production/files/2016-06/documents/drinkingwaterhealthadvisories_pfoa_pfos_updated_5.31.16.pdf November, 2016.

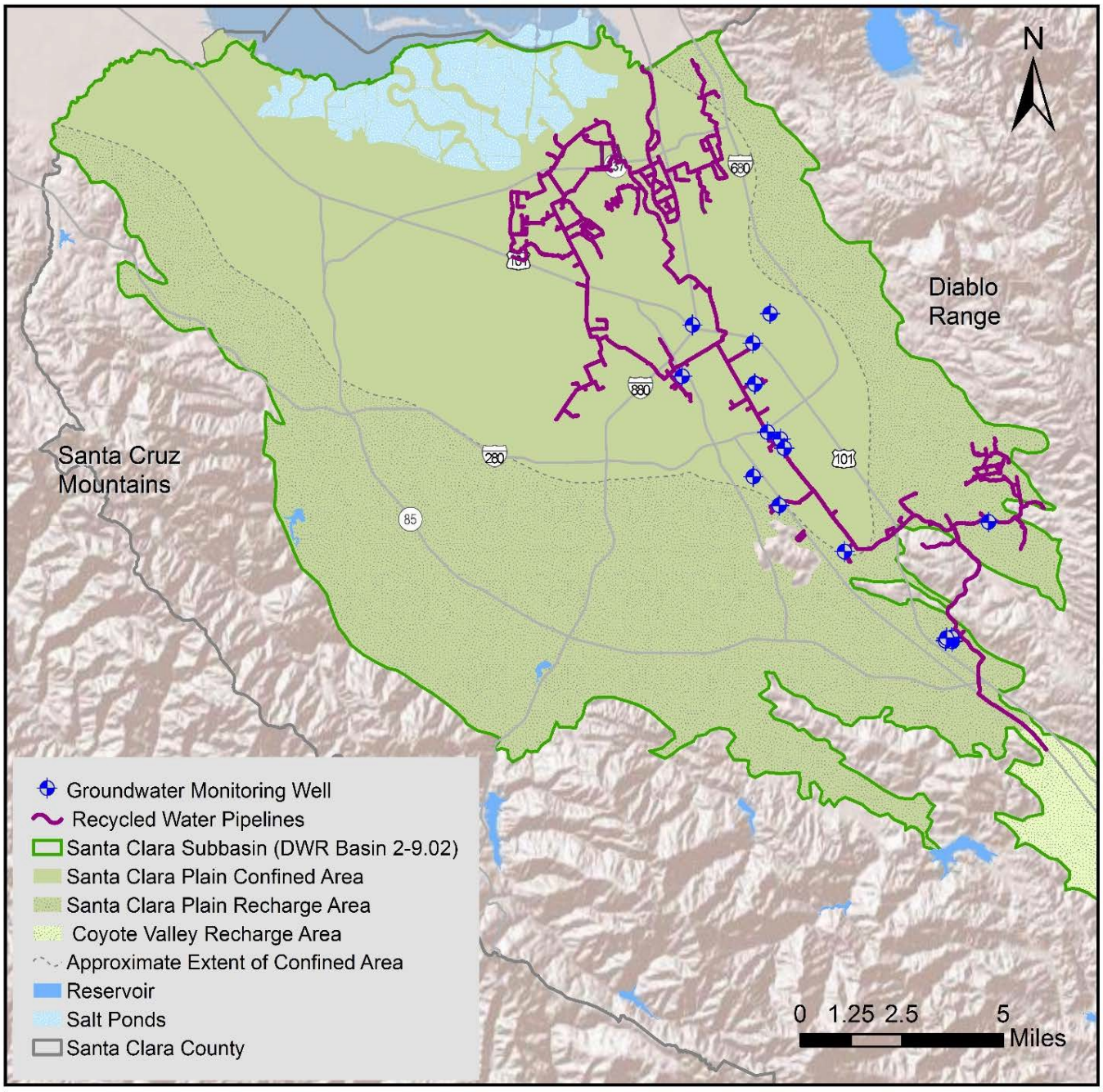
Table 12. Groundwater Quality Concentration Trends at Santa Clara Plain Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Trends	Number of Wells with Stable Trends	Number of Wells with Decreasing Trends
Bicarbonate	4	13	0
Bromide	1	3	0
Calcium	2	13	2
Chloride	7	8	2
Magnesium	2	13	2
Nitrate	1	11	5
N-Nitrosodimethylamine	0	4	0
N-Nitrosodi-n-Butylamine (NDBA)	0	4	0
Perfluorooctanoic Acid (PFOA)	0	4	0
Perfluorooctane Sulfonate (PFOS)	0	4	0
Perfluorobutanoic Acid (PFBA)	0	4	0
Potassium	6	11	0
Sodium	2	14	1
Sulfate	0	13	4
Total Dissolved Solids (TDS)	4	10	3

Note: Table 12 summarizes the trend analysis for wells with more than five data points for a given parameter over a varying period of record, with the earliest data point in 1997. The total number of wells for each constituent is either 4 or 17; some constituents were monitored in all wells while other constituents were monitored in only the 4 IDT wells. Trends were analyzed with the Mann-Kendall technique.

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Figure 27. Groundwater Monitoring Near Santa Clara Subbasin Recycled Water Irrigation Sites



Llagas Subbasin

Recycled water used in the Llagas Subbasin is tertiary treated wastewater produced by the SCRWA and distributed to several locations in Gilroy. The District monitors groundwater in 20 wells at various recycled water irrigation sites (Figure 28). The District analyzes well water samples for basic water quality parameters, ions, DBPs, PFCs, NDMA, bacterial constituents, and other parameters commonly encountered in recycled water. Groundwater monitoring continues to show that recycled water irrigation influences shallow groundwater quality, as summarized below.

NDMA continued to be detected in SCRWA recycled water (in one of two quarters sampled) at a concentration of 3 ng/L. However, NDMA was not detected in groundwater in 2017. There have only been three NDMA detections in wells since monitoring began in 2012: twice in 2012 at two wells in Christmas Hill Park (at 2 ng/L and 3 ng/L) and once in 2015 at a well near the SCRWA plant (at 3 ng/L). NDBA was detected once in one well in 2017 at a concentration of 2 ng/L. However, NDBA was not detected in the SCRWA recycled water, nor has it been commonly detected in SCRWA recycled water in previous years. The source of NDBA is unknown. NDBA has been occasionally detected in groundwater monitoring water wells in the past.

PFCs continue to be detected in SCRWA recycled water and in several wells at recycled water irrigation sites. PFBA was detected in SCRWA recycled water and in the three shallowest wells located on-site at the SCRWA plant in one or both of two quarters measured. PFBA was also detected for both quarters in a well near Luchessa Avenue and Monterey Street in Gilroy. PFOA and PFOS were also detected in the recycled water and in wells, particularly in the four wells located at the SCRWA plant, where PFOA and PFOS levels were the highest of all recycled water irrigation monitoring wells. The combined levels of PFOA and PFOS in the three shallow wells (depths range from 40 to 47 feet) at the SCRWA plant had a median value of 154 ng/L, exceeding the EPA's 70 ng/L health advisory. Each of the three wells was sampled twice in 2017. Notably, PFOA and PFOS were both also present in the deepest well (110 feet deep) at the SCRWA plant. This well was also sampled twice in 2017, and the median combined concentration was 30 ng/L. This suggests the possible downward migration of PFOA and PFOS from the on-site sludge drying ponds into shallower wells and then the deeper well. PFOA and PFOS have been regularly detected in all SCRWA wells since monitoring for these parameters began in 2012. It does not appear that the concentrations of PFOA and PFOS are increasing over time in these wells but a general pattern of a higher concentration of PFOA and PFOS in the three shallow wells relative to the deep well appears to be present.

The secondary MCL for TDS (500 mg/L) was exceeded in numerous recycled water irrigation monitoring wells; the

median TDS value for all wells is 567 mg/L. Most wells have an ionic composition more like natural groundwater than recycled water; however, three of the four wells located on-site at the SCRWA plant have ionic compositions more similar to recycled water than to groundwater, suggesting the influence of recycled water on groundwater quality.

Table 13 presents a summary of groundwater quality trends at sites where recycled water is used for irrigation. For all parameters the majority of wells demonstrate stable or decreasing concentration trends, suggesting that groundwater quality is not changing significantly over time in the Llagas Subbasin.

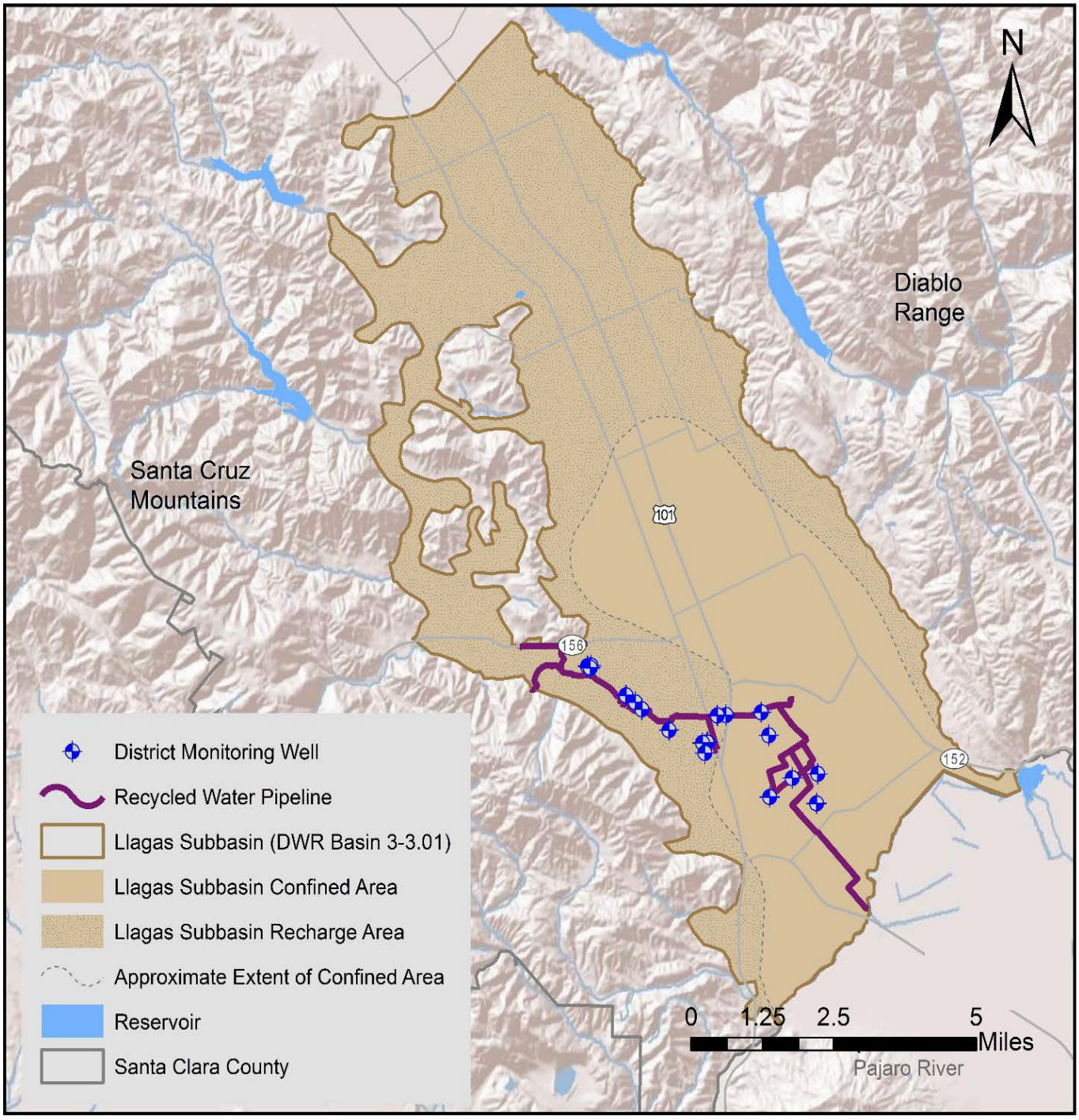
Table 13. Groundwater Quality Concentration Trends at Llagas Subbasin Recycled Water Irrigation Sites

Parameter	Number of Wells with Increasing Trends	Number of Wells with Stable Trends	Number of Wells with Decreasing Trends
Bicarbonate	3	16	1
Bromide	2	17	1
Calcium	4	16	0
Chloride	1	17	2
Magnesium	4	16	0
Nitrate	3	17	1
N-Nitrosodimethylamine (NDMA)	0	20	0
N-Nitrosodi-n-Butylamine (NDBA)	0	19	1
Perfluorooctanoic Acid (PFOA)	0	19	1
Perfluorooctane Sulfonate (PFOS)	2	18	0
Perfluorobutanoic Acid (PFBA)	0	19	1
Potassium	3	17	0
Sodium	1	18	1
Sulfate	3	17	0
Total Dissolved Solids (TDS)	1	16	3

Note: Table 13 includes wells with 2017 detections and more than five data points for a given parameter over a varying period of record (earliest data point in 2002). Trends were analyzed with the Mann-Kendall technique.

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Figure 28. Groundwater Monitoring Near Llagas Subbasin Recycled Water Irrigation Sites



5.6 Salt and Nutrient Management Plans

The SWRCB's 2009 Recycled Water Policy required the development of regional Salt and Nutrient Management Plans (SNMPs) to address current and future regional salt and nutrient loading to groundwater from all sources, including recycled water and agricultural activity. The District completed two SNMPs, one for the Santa Clara Subbasin and one for the Llagas Subbasin by working with local stakeholders and regulators. The plans are posted to the District's website[15] and include salt and nutrient source identification, loading, assimilative capacity estimates, recycled water projections, implementation measures, groundwater monitoring provisions, and an anti-degradation analysis. The San Francisco Bay Regional Water Quality Control Board adopted resolution R2-2016-0046 approving the Santa Clara Subbasin SNMP in November 2016. The Central Coast Regional Water Quality Control Board does not plan to endorse specific SNMPs. Both agencies will use these plans to evaluate future recycled water projects.

The SNMPs estimate and project long-term trends in concentrations of salts (using total dissolved solids) and nutrients (using nitrate) in groundwater through the year 2035. Table 14 compares the SNMP projections for 2017 with the median values based on wells sampled in 2017.

Table 14. Comparison of 2017 Median Concentrations with Projected 2017 SNMP Median Concentrations

Groundwater Management Area	2017 SNMP Projected Median	2017 Actual Median	2017 SNMP Projected Median	2017 Actual Median
	TDS, in mg/L		Nitrate as N, in mg/L	
Santa Clara Plain	432	414	2.3	3.1
Coyote Valley	321	372	3.3	7.2
Llagas Subbasin, Shallow Zone	396	388	7.0	10.0
Llagas Subbasin, Principal Zone	376	370	6.4	5.2

Notes:

1) The projected medians are based on the 2017 estimates from the SNMPs. The actual medians are based on 2017 groundwater sample analysis. The Llagas Subbasin SNMP projects the median for both the northern and southern portions of the subbasin. The projected SNMP median shown in this table for each aquifer zone is the average of the north and south subbasin medians.
2) June 2016 SNMP Santa Clara Plain projected median concentrations were not evaluated for shallow and principal aquifer zones separately.

The SNMPs apply several simplifying assumptions to project future salt and nutrient concentrations, such as

instantaneous mixing, and therefore are likely to estimate higher concentrations than will actually occur. Measured median concentrations of TDS and nitrate are similar to SNMP projections for the Santa Clara Plain. In the Coyote

[15] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-studies

Valley, measured TDS and nitrate levels are higher than what was projected in the SNMP. SNMP projections are based on actual data through 2012, so the effects of the severe drought that occurred between 2011 and 2015 are not reflected in the estimates and may account for the discrepancy. In the Llagas Subbasin, measured TDS concentrations are slightly higher than projected in the SNMP, whereas nitrate concentrations are lower. As shown in Table 8 and Figures 23 and 24, regional trends for both TDS and nitrate concentrations are generally stable or decreasing in the Santa Clara Plain, Coyote Valley, and the Llagas Subbasin. TDS and nitrate median concentrations and changing conditions will continue to be evaluated to better understand the causes for fluctuations including the effects on shallow and principal groundwater aquifers.

5.7 Contaminant Release Sites

There are over 350 open cases where non-fuel contaminants have been released to soil and/or groundwater in the county. These cases are overseen by the United States Environmental Protection Agency (EPA), California Department of Toxic Substances Control (DTSC), and the Central Coast and San Francisco Bay Regional Water Quality Control Boards (Water Boards). There are also nearly 100 open fuel leak sites overseen by the Santa Clara County Department of Environmental Health (DEH), of which 3 are eligible for closure, 26 are undergoing site assessment, 12 are undergoing remediation, 28 are in verification monitoring, and the rest are inactive. In addition, there are over 20 active Superfund sites in Santa Clara County overseen by the EPA. Although there have been very limited impacts to principal drinking water aquifers from these sites, contaminant release sites pose an ongoing threat to groundwater quality.

In 2017, 11 drinking water supply wells had low-level detections of 11 different VOCs.[16] All concentrations of detected contaminants remained below regulatory thresholds, as summarized in Appendix C, Table C-4. The interconnection between contaminated release sites and drinking water supply wells underscores the importance of the ongoing work by the Water Boards, DTSC, and the EPA to ensure that contaminant release sites are properly remediated to protect water supply reliability.

The District also engages in contaminant release sites, prioritizing which cases are closely tracked based on groundwater vulnerability, proximity to water supply wells or surface water, and contaminant concentration. District staff reviews monitoring and progress reports submitted to regulatory agencies by responsible parties, as well as any regulatory orders or correspondence. Staff attends community meetings for high-threat cases and advocates for expedited cleanup through collaboration with regulatory agencies. The District also provides technical review of other contaminant release sites when requested by regulatory agencies, and shares groundwater data to support their work.

In 2017, the following high-priority contaminant release cases had noteworthy developments:

[16] None of the wells with VOC detections has all 9 compounds detected; typically, just one or a few related compounds are detected in a single well.

Olin Corporation, 425 Tennant Avenue, Morgan Hill

Perchlorate cleanup activities by the responsible party, including operation of the off-site extraction system, continue. In 2017, over 526 AF of groundwater were treated and approximately 19 pounds of perchlorate were removed. Since 2004, 1.27 billion gallons (about 3,900 AF) of groundwater have been treated, removing a total of 234 pounds.

The Olin Corporation, the responsible party, began a Gradient Driven Remediation (GDR) pilot study in 2012. GDR was designed to leverage existing downward vertical gradients to exert hydraulic control and reduce perchlorate concentrations in the lower deep aquifer. Water level monitoring demonstrated that while downward flow increased, the desired hydraulic effect was not achieved, and perchlorate concentrations within the lower deep aquifer did not change appreciably. GDR wells were monitored throughout 2017 and continued to indicate that GDR did not enhance hydraulic control or measurably enhance the long-term trend of declining perchlorate concentrations; thus the pilot study was terminated. Olin is currently expanding the off-site extraction system to provide increased capture in the intermediate aquifer immediately south of the site.

Olin's analysis of regional perchlorate monitoring results in 2017 found that concentration trends were stable or declining in all aquifers throughout the Llagas Subbasin.[17] While the number of domestic wells impacted by perchlorate has been dramatically reduced (99%), there remain six domestic wells with perchlorate above the 6 ug/L MCL. Olin's consultants conclude that the plume core is stable or shrinking and recommend that monitored attenuation remain the primary means for addressing remediation outside the plume core. District staff continues to review related site submittals, engage with the Central Coast Water Board, participate in Perchlorate Community Advisory Group meetings, and advocate for expedited cleanup.

Hillview Cleaners, 1440 Big Basin Way, Saratoga

The Hillview Cleaners site is a dry cleaner site that has released perchloroethene (PCE) to soil and groundwater, resulting in PCE discharges to Saratoga Creek. Two pilot studies were completed at the site, including injection of electron donor compounds to enhance anaerobic biodegradation of PCE. Groundwater elevation measurements and creek gaging confirmed that Saratoga Creek was a gaining stream near the site throughout 2017. Creek sampling confirmed that PCE continues to be detected more than 300 feet downstream of the storm drain outlet associated with groundwater discharge from the site.[18] The approved Remedial Action Plan, which calls for enhanced bioremediation, has not been implemented. The District will continue to engage in the review of related site documents, engage with the San Francisco Water Board, and advocate for timely and thorough cleanup.

Moffett Field, Middlefield-Ellis-Whisman (MEW) Sites, Mountain View

This area includes four Superfund sites and more than 15 individual contaminant release sites with soil and shallow

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[17] Olin Corporation, 2018. 2017 Annual Cleanup Progress Status Report, 425 Tennant Ave, Morgan Hill, CA, Section 7.1.

Olin Corporation, 2017. 2017 Semiannual Groundwater Monitoring Report, Report, 425 Tennant Ave, Morgan Hill, CA, Section 7.1. Available on www.GeoTracker.gov

[18] PES Environmental, 2017. Semi-Annual Progress Report, 2nd Half 2017, Hillview Cleaners Site, 14440 Big Basin Way, Saratoga, California. Available on www.geotracker.gov

groundwater contamination by trichloroethene (TCE) and other VOCs. MEW has reduced site-wide groundwater level monitoring and groundwater quality sampling to annual and biennial frequencies, respectively. In 2017, the groundwater treatment system pumped 9.0 million gallons of groundwater (28 AF) to remove 1.8 pounds of VOCs. Sampling conducted in 2017 indicates that VOC concentrations and distribution within Moffett Field remain relatively constant.[19] District staff continues to participate in related MEW, Moffett Field Regional Advisory Board and EPA community meetings.

United Technologies Corporation, 600 Metcalf Road, Santa Clara County

United Technologies Corporation owns and occupies a large (5,113 acre) property upstream of Anderson Reservoir, where it has operated a solid rocket motor research and development facility since 1959. Various VOCs and perchlorate have been released from the site and detected in soil, groundwater, and seasonal creeks. In 2017, there were perchlorate detections up to 4.7 ug/L in the creek sampling station downstream of the site. However, perchlorate has not been detected in Anderson Reservoir above laboratory reporting limits. Between May 2016 and April 2017, 40.97 million gallons (126 AF) of groundwater were treated, removing 19.13 pounds of VOCs, 225.85 pounds of perchlorate, and 1.53 pounds of 1,4-dioxane. Concentrations of perchlorate, VOCs, and 1,4-dioxane in monitoring wells remained relatively constant in 2017. Monitoring data demonstrate that multiple extraction wells maintain hydraulic control to prevent further migration of contaminated groundwater from the site. Performance of the three in-situ bioremediation trenches was monitored in 2017. Results show that with a few exceptions, the trenches are performing as intended, biologically reducing perchlorate as groundwater passes through the trenches filled with pea gravel, compost, and walnut shells coated with soybean oil.[20] UTC reports monitoring results annually in July.

Fuel Leak Cases

District staff continues to coordinate with the DEH to provide technical support and review as necessary. The District received 7 public notices of fuel leak site closures; all proposed closures appeared to be warranted and no comments were submitted.

5.8 Well Ordinance Program

The District's well ordinance program helps ensure that wells and other deep excavations are properly constructed, maintained, and destroyed to prevent vertical transport of contaminants into deep drinking water aquifers. The District issued nearly 1,400 well permits in 2017, primarily for well destruction and monitoring well construction. The District also inspected over 1,100 wells to ensure they were properly constructed or destroyed (Table 15).

[19] National Aeronautics and Space Administration (NASA) Ames Research Center, 2018. 2017 Annual Self-Monitoring Report, NASA Ames Research Center, Moffett Field, California

[20] Arcadis U.S., 2017. 2017 Annual Environmental Monitoring Report, United Technologies Corporation, 600 Metcalf Road, San Jose, California. Available on www.geotracker.gov

Table 15. CY 2017 District Well Permit and Inspection Summary

Permit Type	Number Processed
Well Construction - Water Producing Wells	68
Well Construction - Monitoring Wells	433
Well Destruction	585
Exploratory Boring	292
Total	**1,378**
Inspection Type	**Number Inspected**
Well Construction - Water Producing Wells	66
Well Construction - Monitoring Wells	407
Well Destruction	457
Exploratory Boring	207
Total	**1,137**

Groundwater Quality Outcome Measures

The evaluation of 2017 groundwater quality data against the Groundwater Management Plan outcome measures is summarized below. Additional discussion of outcome measures, including planned action to address measures not being met, is presented in Chapter 6.

OM 2.1.1.e. At least 95% of countywide water supply wells meet primary drinking water standards.
Outcome not met. Only 79% of countywide water supply wells tested in 2017 met all primary drinking water standards; 99% of countywide water supply wells met all primary drinking water standards when excluding nitrate exceedances. The majority of MCL exceedances were due to elevated nitrate levels in South County, primarily in domestic wells.

OM 2.1.1.f. At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives.
Outcome met. This measure is met with 97% of all Coyote Valley and Llagas Subbasin wells meeting Basin Plan agricultural objectives in 2017.

OM 2.1.1.g. At least 90% of wells have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids.
Outcome partially met. This measure is not met for chloride, with only 82% of wells having stable or decreasing concentrations. The measure is met for nitrate and for total dissolved solids with 91% and 94%,

CHAPTER 6 – GROUNDWATER MANAGEMENT PLAN IMPLEMENTATION

This chapter summarizes the status of GWMP implementation, including outcome measure performance, recommendations, and SGMA compliance.

6.1 Outcome Measure Performance and Action Plan

The GWMP identifies outcome measures to assess performance relative to Board policy and groundwater sustainability goals. The status of these measures using CY 2017 data is shown in Table 16 below, along with recommended actions to address measures not being met.

Table 16. Summary of Outcome Measure Performance

Groundwater Storage	**OM 2.1.1.a.** Greater than 278,000 AF of projected end of year groundwater storage in the Santa Clara Plain. Estimated end of 2017 storage: 302,400 AF **OM 2.1.1.b.** Greater than 5,000 AF of projected end of year groundwater storage in the Coyote Valley. Estimated end of 2017 storage: 10,700 AF **OM 2.1.1.c.** Greater than 17,000 AF of projected end of year groundwater storage in the Llagas Subbasin. Estimated end of 2017 storage: 25,800 AF
Groundwater Levels and Subsidence	**OM 2.1.1.d.** 100% of subsidence index wells with groundwater levels above subsidence thresholds. All ten wells had groundwater levels above thresholds in 2017.
Groundwater Quality	**OM 2.1.1.e.** At least 95% of countywide water supply wells meet primary drinking water standards. Only 79% of wells tested in 2017 met primary drinking water standards due to elevated nitrate, mainly in South County domestic wells. If nitrate is not included, 99% of water supply wells met primary drinking water standards. **OM 2.1.1.f.** At least 90% of Coyote Valley and Llagas Subbasin wells meet Basin Plan agricultural objectives. Nearly all wells (97%) met agricultural objectives.
	Action Plan for OM 2.1.1.e: Implement Salt and Nutrient Management Plans to address nitrate, continue free domestic well testing and nitrate treatment system rebate programs, and continue collaborating with regulatory and land use agencies.
Groundwater Quality Trends	**OM 2.1.1.g.** At least 90% of wells in both the shallow and principal aquifer zones have stable or decreasing concentrations of nitrate, chloride, and total dissolved solids. This measure is not met for chloride, with 82% of wells showing stable or decreasing concentrations. The measure is met for nitrate and total dissolved solids, with stable or decreasing concentrations observed in 91% and 94% of wells, respectively.
	Action Plan for OM 2.1.1.g: Implement Salt and Nutrient Management Plans to address salt loading, continue collaborating with regulatory and land use agencies.

Outcome measure met

Outcome measure not met

As shown in Table 16, all outcome measures related to groundwater storage, levels, and land subsidence were met in 2017. This marks an improvement from CY 2016 when groundwater levels and storage were still recovering from the recent multi-year drought. The rapid recovery to pre-drought conditions demonstrates the effectiveness of significant investments in diverse water supplies and conjunctive water management, as well as close coordination with water retailers.

While most wells have stable or decreasing long-term chloride trends, increasing trends in a number of shallow aquifer wells warrant further evaluation. The District will assess the potential cause, continue to implement the Salt and Nutrient Management Plans, and engage with regulatory and/or land use agencies as needed.

Elevated nitrate continues to be the primary groundwater protection challenge, particularly in South County. This condition is not unique to Santa Clara County as nitrate contamination is an issue in many agricultural or rural areas throughout the state. Long-term nitrate trends in Santa Clara County indicate stable or improving conditions, which is certainly preferable to worsening conditions. However, a significant number of South County wells (primarily domestic wells) still contain nitrate above the drinking water standard. The District does not control land use or have regulatory authority over activities with the most nitrate loading to groundwater, such as irrigated agriculture or septic systems. However, the District continues to coordinate with land use and regulatory agencies to influence policies, regulations, and decisions related to nitrate management. More directly, the District's managed recharge programs help dilute nitrate in groundwater, and water quality testing and treatment system rebates help to reduce well owner exposure.

6.2 Status of Groundwater Management Plan Recommendations

As described in the GWMP and demonstrated in this report, the District's proactive groundwater management programs and activities have maintained sustainable groundwater levels and storage, minimized land subsidence, and improved groundwater protection. Chapter 8 of the GWMP presents six major recommendations to maintain the long-term viability of groundwater resources. The status for each GWMP recommendation is presented below.

1. **Maintain existing conjunctive water management programs and evaluate opportunities for enhancement or increased efficiency.**

   This GWMP recommendation has several sub-recommendations, including items related to infrastructure reliability, high-priority capital project implementation, and securing imported water sources, among others. The District continues to focus on extensive groundwater recharge through direct replenishment and in-lieu recharge. Updates relative to this GWMP recommendation are presented below.

Capital Projects Supporting Conjunctive Management

The District's Final Fiscal Year 2019-23 Five-Year Capital Improvement Program (CIP) was adopted by the Board on May 8, 2018.[1] With a significant portion of the District's water supply infrastructure approaching fifty to sixty years of age, maintaining and upgrading the existing infrastructure to ensure each facility functions as intended for its

[1] The 2019-23 CIP is available at: https://www.valleywater.org/how-we-operate/five-year-capital-improvement-program

useful life became the focus of the Water Supply Capital Improvement Program in recent years. Other CIP projects focus on expanding in-lieu and direct recharge through recycled and purified water projects. Major water supply capital improvements identified in the CIP include:

Storage:

- Almaden Dam Improvements
- Anderson Dam Seismic Retrofit
- Calero Dam Seismic Retrofit
- Guadalupe Dam Seismic Retrofit

Transmission:

- 10-Year Pipeline Rehabilitation
- Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) Implementation
- Main and Madrone Pipeline Rehabilitation
- Vasona Pumping Plant Upgrade

Treatment:

- Penitencia Water Treatment Plant Residuals Management
- Rinconada Water Treatment Plant Reliability Improvement

Recycled Water:

- Expedited Purified Water Program
- South County Recycled Water Pipeline

Detailed information on each of these water supply capital projects, including related description, costs, and schedule, is available in the CIP.

California WaterFix

On May 8, 2018, the District Board voted to participate in the California WaterFix project, the state's proposed plan to improve the infrastructure that carries water through the Sacramento-San Joaquin Delta. This vote is in line with the Board's Oct. 17, 2017 vote which offered conditional support to the project and asked that the state consider a lower-cost, scaled-down and phased project. The District will continue to engage in and negotiate

financial arrangements and agreements to ensure local interests are served and Santa Clara County benefits are achieved.

2. **Continue to aggressively protect groundwater quality through District programs and collaboration with land use agencies, regulatory agencies, and basin stakeholders.**

   Sub-recommendations from the GWMP include continued groundwater quality monitoring, action when potentially adverse trends are identified, and continued/enhanced collaboration with local partners and stakeholders.

As described in Chapter 5, the District continues to conduct extensive groundwater quality monitoring, evaluate long-term trends, and compare current conditions against regulatory standards and projected concentrations (such as from Salt and Nutrient Management Plans). While long-term trends are favorable for nitrate, more work remains to be done and the District will continue to engage with regulatory and land use agencies to address existing nitrate contamination. For nitrate and other water quality issues, the District will work to build and enhance this collaboration to protect high-quality groundwater and expedite the restoration of impacted groundwater. The District is working with land use agencies on a Stormwater Resources Plan to increase infiltration while ensuring pollutants from urban runoff are not merely transmitted from surface water to groundwater. Similarly, the District continues to engage with various entities to ensure that recycled water expansion or the use of purified water for recharge will be protective of groundwater quality.

The District also reviews proposed legislation and policies (both statewide and local) to protect the county's water resources and the District's ability to manage them. In 2017, this included tracking and engaging on proposed legislation related to groundwater, including bills on groundwater sustainability, well permitting, water rights and underground storage, safe drinking water, onsite water treatment, and water supply planning.

Public outreach continues to be an important component of the District's groundwater protection efforts. To help keep the public informed about current groundwater and water supply conditions, the District prepares monthly Water Tracker reports that are posted on the District website.2 The District also posts monthly groundwater condition reports that contain more detailed information on groundwater pumping, recharge, and water levels.3

In 2017, the District celebrated Groundwater Awareness Week (March 5-11) by highlighting groundwater on the District website and posting related social media messages. The District also maintained its status as a Groundwater Guardian through a program sponsored by the non-profit Groundwater Foundation. This is an annually earned designation for communities and affiliates that take voluntary, proactive steps toward groundwater protection.

To provide information on well sampling by the District and local water suppliers, the District mailed the 2017 Groundwater Quality Summary to all well owners in July 2018 (Appendix B). This is similar to water retailer consumer confidence reports and provides basic groundwater quality information to domestic well owners who do not typically receive water from a water retailer.

Other groundwater-related public outreach conducted by the District in 2017 included:

- Interaction with thousands of students through the Education Outreach program.
- Direct communication with well owners on groundwater quality, well maintenance, and treatment systems under the Domestic Well Testing and Nitrate Treatment System Rebate programs.

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[2] https://www.valleywater.org/your-water/water-supply-planning/monthly-water-tracker
[3] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater/groundwater-monitoring

- Groundwater presentations or information at the Small Acreage Stewardship Workshop hosted by the Loma Prieta Resource Conservation District and various public meetings and open houses held by the District.
- Presentation of information on nitrate and perchlorate monitoring results at the Perchlorate Community Action Group meetings.

3. Continue to incorporate groundwater sustainability in District planning efforts.

This GWMP recommendation focuses on continued, thoughtful water supply planning and investments. The District is working to complete an update to the Water Supply Master Plan to address future challenges to maintaining reliable groundwater supplies and implement related projects as appropriate. Staff has held multiple workshops with water retailers and stakeholders, and presented information to the Board and the Board's Water Conservation and Demand Management Committee on numerous occasions. These presentations have included information on the proposed level of service target and potential water supply portfolios. All portfolios currently under consideration include the "No Regrets" package, which includes advanced metering infrastructure, leak repair incentives, expansion of our graywater program, a model ordinance for new developments, decentralized stormwater capture (e.g., incentives for rain barrels, cisterns, and rain gardens), and centralized stormwater capture (e.g., flooding of agricultural lands).

Groundwater sustainability also remains an important factor during the planning and implementation of multi-benefit projects under the District's One Water Plan. The Sustainable Groundwater and Water Quality objectives of the One Water Plan align with the GWMP outcome measures and the process to identify individual projects on the watershed scale (e.g., Coyote Watershed) accounts for groundwater conditions and sustainability.

4. Maintain adequate monitoring programs and modeling tools.

This GWMP recommendation focuses on: improving monitoring networks by identifying and addressing gaps, redundancies, and access issues; identifying and implementing improvements to the numerical groundwater flow models; and improving the District's understanding of surface water/groundwater interaction.

The District is currently evaluating the recycled water and recharge water quality monitoring networks to ensure they meet monitoring objectives in terms of frequency, locations, and constituents analyzed. For the three groundwater flow models used, the District is assessing each model to identify related improvements or enhancements that may be needed or desired to improve the use of these tools.

Regarding surface water/groundwater interaction, District staff has begun to evaluate existing available data for stream gauging and groundwater levels. The District is also evaluating whether existing wells adjacent to creeks may be useful in collecting additional data to better understand the interaction between groundwater and surface water. Groundwater/surface water interaction is a complex and dynamic issue, and the District plans to engage stakeholders on this topic once the analysis of available data is complete.

5. Continue and enhance groundwater management partnerships with water retailers and land use agencies.

This GWMP recommendation focuses on continued collaboration and strong partnerships with water retailers and land use agencies. The District continues to interact regularly with water retailers through Water Retailer meetings, including the Groundwater Subcommittee. In addition to these quarterly meetings, the District and water retailers collaborate on various issues that arise regarding groundwater, treated water, wells, and water measurement.

The District also continues to coordinate with local land use agencies on General Plans, water supply assessments, Urban Water Management Plans, stormwater management, and various individual land use projects. Land use decisions fall under the authority of the local cities and the County of Santa Clara. The District reviews land use and development plans related to District facilities and watercourses under District jurisdiction, and provides technical review for other land use proposals as requested by the local agency. Water supply assessments for new developments are also reviewed and evaluated in the context of the District's long-term water supply plans. For all reviews, the District's groundwater-related comments focus on potential impacts to groundwater quality and sustainability. In 2017, the District consulted with land use agencies on various issues and sites, including groundwater vulnerability and stormwater infiltration devices, and submitted groundwater-related comments on the following land use proposals:

- City of Palo Alto Draft Comprehensive Plan Update 2030 and Final EIR
- City of San Jose Storm Sewer Master Plan
- Coyote Valley RV Resort Expansion Mitigated Negative Declaration
- Hale Santa Teresa Extension EIR
- North Bayshore Precise Plan EIR

6. Evaluate the potential new authorities provided by the Sustainable Groundwater Management Act.

This GWMP recommendation focused on the evaluation of these new authorities in cooperation with water retailers and other interested stakeholders to consider what conditions might necessitate their implementation to sustainably manage groundwater into the future.

The District submitted the 2016 Groundwater Management Plan for the Santa Clara and Llagas Subbasins to DWR as an Alternative to a Groundwater Sustainability Plan (GSP) prior to the January 2017 statutory deadline. Throughout 2017, the District explored new SGMA authorities in coordination with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). The District Act

already provided broad authorities for groundwater management and the new SGMA authorities added the abilities to regulate pumping and well construction and impose various types of fees.

Nine publicly-noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities might be used. As a result, the District is further exploring the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This could potentially reduce volatility in rates and

revenues based on changes in water use.

The potential regulation of pumping or well construction, a complex and controversial topic, was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results, should they occur or be projected to occur. The primary SGMA-related work product from the Committee meetings was a process that describes the fundamental approach to respond to worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be effective in addressing a future issue. This process was memorialized via a resolution adopted by the District Board on February 27, 2018 (Appendix E).

6.3 Status of Sustainable Groundwater Management Act Compliance

Following a public hearing in June 2017, the District Board adopted a resolution to become the GSA for the small portions of the Hollister and San Juan Bautista subbasins within Santa Clara County.[4] The District also executed a Memorandum of Understanding (MOU) with the San Benito County Water District, the GSA for the portions of the subbasins located within that county. This MOU defines the responsibilities of each agency in developing a GSP for the Hollister and San Juan Bautista subbasins by the statutory deadline of January 2022.

In March 2018, the District submitted the first annual report required by SGMA prior to the April 1 statutory deadline. The Water Year 2017 Report for the Santa Clara and Llagas Subbasins is attached as Appendix E. SGMA requires certain information be reported annually by April 1 for the previous water year. However, most District planning efforts are based on the calendar year. While this Annual Groundwater Report presents some of the same information based on the calendar year, it also provides more detailed information on groundwater conditions, particularly regarding groundwater quality.

The District is awaiting DWR review of the GWMP, which was submitted as an Alternative to a GSP in December 2016. Per SGMA, DWR will review the Alternative within two years of submittal, and will issue an assessment of the plan.

Continued groundwater sustainability is central to the District mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. As such, the District will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land

subsidence and salt water intrusion," in accordance with Board policy. The District's approach to groundwater management has evolved over many decades to address numerous challenges, and this adaptive approach will help ensure continued sustainability.

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[4] This followed District action in May 2016 to become the GSA for the Santa Clara and Llagas subbasins.

Appendix A

2017 Subsidence Data Analysis Report

2017 SUBSIDENCE DATA ANALYSIS

Prepared by:

Yaping Liu, Ph.D., P.E.
Associate Civil Engineer

Under the Direction of:

Bassam Kassab, P.E.
Senior Water Resources Specialist

Vanessa De La Piedra, P.E.
Unit Manager

Santa Clara Valley Water District
Groundwater Management Unit

March 2018

2017 Annual Groundwater Report

EXECUTIVE SUMMARY

This technical memo presents land subsidence data analysis for calendar year 2017. Historically, land subsidence has been an issue in the Santa Clara Plain in northern Santa Clara County due to groundwater overdraft and declining groundwater elevations. Permanent (inelastic) subsidence was essentially halted in the early 1970s through the Santa Clara Valley Water District's (District's) conjunctive management programs and investments (SCVWD, 2017). However, ongoing monitoring is critical to fulfill the District goals of minimizing land subsidence and salt water intrusion (Board Ends Policy 2.1.1). Monitoring provides data to evaluate current conditions and early detection of the potential resumption of permanent subsidence. Annually, the District analyzes land subsidence monitoring data, evaluates subsidence conditions, and recommends improvements to the subsidence monitoring network. Data collected from 2007 to 2017 is used in this analysis.

2017 annual precipitation was normal, 15.66 inches, in the Santa Clara Valley. The annual groundwater pumping of 2017 from the Santa Clara Plain was 69,600 acre-feet (AF), an increase of about 13,700 AF from 2016. 2017 annual pumping was below the ten-year average of 91,500 AF from 2004 to 2013. 2017 managed recharge was about 67,600 AF, slightly above the ten-year average of 62,900 AF from 2004 to 2013. The total recharge, including managed and natural recharge, was about 93,500 AF. Since total recharge exceeded groundwater pumping, the overall groundwater elevation was in the upward trend in the Santa Clara Plain. Furthermore, water use reductions achieved by retailers and the community contributed to the healthy groundwater conditions observed in 2017. The average groundwater elevations in 2017 were higher than 2016, the land surface elevation lifted up as well, as shown in the benchmark survey and extensometer monitoring analyses.

The data measured in 2017 through the District's subsidence monitoring network show the following:

- Aquifer expansion was measured at the District's two extensometer sites in 2017. The average annual subsidence rate over the last 11 years at the San Jose (Martha) and Sunnyvale (Sunny) sites is 0.001 feet/year, which is less than the District's established tolerable rate of 0.01 feet/year.
- 2017 annual average of groundwater elevations was higher than 2016 and groundwater elevations were above subsidence thresholds at all ten index wells in the entire year. Water elevations in index wells were close to or at historical high elevations at the end of 2017.
- The benchmark survey data showed that the land surface elevations in 2017 were generally higher than 2016, indicating a continuing recovery from land subsidence caused by the drought between 2012 to 2015. The average annual change of land surface elevations of all benchmarks over the last 11 years was zero.

The analysis of the data collected through the District's subsidence monitoring network indicates that the risk of land subsidence in 2017 was less than 2016. The impact of the drought between 2012 and 2015 was alleviated due to higher groundwater elevation and, subsequently, recovery in land surface elevation. Continued monitoring of the subsidence network is needed to detect early signs of permanent land subsidence in the future and to ensure sustainable groundwater management.

2017 Annual Groundwater Report

BACKGROUND

The Santa Clara Plain is a groundwater management area occupying the northwestern and largest part of the Santa Clara Subbasin. The Santa Clara Plain extends from Santa Clara County's northern boundary to approximately Metcalf Road in the Coyote Valley and is bounded on the west and east by the Santa Cruz Mountains and the Diablo Range, respectively (Figure 1). Land subsidence has caused serious problems in the past in the Santa Clara Plain, including nearly 13 feet of permanent subsidence in downtown San Jose and more than a foot of inelastic (permanent) subsidence over a hundred square miles.

Ongoing monitoring provides data for current land subsidence evaluation and early detection of potential inelastic subsidence. The District land subsidence monitoring network (Figure 1) includes:

- Two extensometers: one in Sunnyvale (Sunny) and one in San Jose (Martha), both monitored daily;
- 143 benchmarks along three Cross Valley Level Circuits (CVLCs) surveyed in the fall of 2017; and
- Ten subsidence index wells with groundwater elevations monitored periodically.

EVALUATION

Figure 1 shows a map of the District subsidence monitoring network in the Santa Clara Plain. Two extensometers are in the confined area of the Santa Clara Plain. Benchmarks are grouped into three CVLCs: Guadalupe (northwest-trending circuit along the axis of the valley), Los Altos (west-east trending circuit to the north), and Alum Rock circuit (west-east trending circuit to the south). Ten subsidence index wells are located throughout the Santa Clara Plain.

Groundwater elevation analysis

Groundwater elevation monitoring is an integral part of the land subsidence monitoring program since the decrease in water elevation is the driving force of land subsidence in the Santa Clara Plain. The current frequency of groundwater elevation monitoring at subsidence index wells varies from daily to quarterly. Water elevation hydrographs at ten index wells are presented in Figure 2, along with the subsidence groundwater elevation thresholds determined for each well (GEOSCIENCE, 1991).

A subsidence threshold is a recommended elevation; maintaining groundwater at elevations near or below the threshold for extended periods of time may increase the risk of subsidence resumption and potential damage to facilities and structures. Historically, land subsidence was observed mainly in the confined area of the Santa Clara Plain. Accordingly, most index wells (eight out of ten) are in or near the confined area. The District's groundwater management goal is to maintain groundwater elevations in the Santa Clara Plain above subsidence thresholds to minimize the risk of resuming permanent land subsidence.

Historical low water elevations at most subsidence index wells were observed in the 1960s and 1970s. Since then, the groundwater elevations have been generally in recovery due to the importation of surface water from the Delta and related increased managed recharge and/or reduced groundwater pumping. Groundwater elevations in the Santa Clara Plain had been generally declining starting in 2012 and reached recent low water elevations in 2014. Water elevations at three subsidence index wells (well numbers ending in E002, C006, and G024) were close to or below subsidence thresholds and caused some concerns about an increased risk of land subsidence.

The annual precipitation for each of 2016 (14.6 inches) and 2017 (15.7 inches) was a little over the median rainfall in downtown San Jose (14.1 inches) after a four-year drought (from 2012 to 2015). The average groundwater elevations continuously rose two years in a row at all subsidence index wells.

Groundwater elevations at the end of 2017 were well above subsidence thresholds and close to or at historical highs in all index wells. The main driver of the water elevation recovery from 2016 to 2017 was the reduced pumping and increased managed recharge. The total recharge amount, including the managed recharge and natural recharge, was about 1.79 and 1.23 times of pumping for 2016 and 2017, respectively. This resulted in the water elevations at end of 2017 being 16 to 139 feet higher than the water elevations in 2014 in subsidence index wells.

It is critical to manage the groundwater basin in a manner that maintains a groundwater gradient towards the San Francisco Bay to keep salt water from entering groundwater. There are three index wells along the bay front: G005, C010, and H015. Since 2012, groundwater elevations in those three wells declined consistently, reaching their recent low elevations in 2014. As described above, a significant water elevation recovery was observed in 2016 and 2017. By the end of 2017, all three bay front index wells were flowing artesian, which reduces the risk of salt water intrusion.

In summary, groundwater elevations measured at subsidence index wells were maintained above subsidence thresholds throughout 2017. Measured groundwater elevations indicate that the risk of both land subsidence resumption and salt water intrusion was reduced in 2017 in comparison to 2014.

Extensometer data analysis

Daily compaction/expansion data measured at two extensometers and depth to water (DTW) measured at or near the extensometers were used for this analysis. An extensometer is a device used to continuously monitor aquifer compaction (land subsidence) and expansion (land uplift). The extensometers were installed in the early 1960s in Sunnyvale (Sunny) and San Jose (Martha) to measure compaction/expansion of the top 1,000-foot aquifer. The extensometer sites were selected in areas with high land subsidence between the 1930s and 1960s. These areas were also pumping centers during that period. The District goal for the average value of subsidence measured at two sites over the last 11 years is not to exceed the District's tolerable subsidence rate of 0.01 feet/year (GEOSCIENCE, 1991).

Long- term data: Cumulative aquifer compaction/expansion and DTW from 1980 to 2017 are presented in Figures 3 and 4 for the Sunny and Martha extensometers, respectively. There are some differences of compaction/expansion and groundwater elevation conditions between the two sites: (1) a net aquifer expansion was observed at Sunny while a net compaction was observed at Martha from 1980 to 2017; (2) the groundwater elevation at Sunny has been above the land surface (negative DTW) since 1993, while the groundwater elevation at Martha has consistently been below the land surface (positive DTW); and (3) the seasonal water elevation change at Sunny is relatively small when compared to that at Martha. Those differences indicate that pumping activities have been reduced significantly near Sunny, while pumping is ongoing near the Martha extensometer, which is in the middle of a wellfield.

Current conditions: Measured extensometer data is used to evaluate current land subsidence conditions. An 11-year average annual subsidence rate is calculated using data measured at Sunny and Martha from 2007 to 2017 and compared to the District's tolerable rate of 0.01 feet/year. Following the convention of subsidence data measured by extensometers, a positive value indicates land subsidence and a negative value indicates land uplift. Table 1 shows measured annual subsidence from 2007 to 2017 and the calculated 11-year average at Sunny and Martha. The 11-year average of annual subsidence rate is 0.001 feet/year, which meets the District tolerable rate of 0.01 feet/year. This value is a little improvement from 0.02 feet/year, the previous 11-year average (2006 to 2016) reported in the 2016 Subsidence Data Analysis Technical Memorandum.

Table 1. Measured annual land subsidence at the Sunnyvale (Sunny) and San Jose (Martha) extensometers from 2007 to 2017

Year	Sunny (feet/year)	Martha (feet/year)	Average at Two Sites (feet/year)
2007	0.012	0.076	0.044
2008	0.010	0.019	0.015
2009	0.008	-0.020	-0.006
2010	-0.025	-0.024	-0.025
2011	-0.009	-0.032	-0.020
2012	-0.014	0.013	0.000
2013	0.026	0.064	0.045
2014	0.049	0.053	0.051
2015	-0.022	-0.021	-0.021
2016	-0.025	-0.087	-0.056
2017	-0.018	-0.007	-0.012
Average from 2007 – 2017	-0.001	0.003	**0.001**

Note: Extensometers measure the compaction of the aquifer, a positive value indicates compaction (subsidence) while a negative value indicates expansion.

Stress-strain analysis: A stress-strain diagram plots DTW against subsidence to analyze seasonal, annual, or multi-year land subsidence. Strain increases with stress. Since a typical groundwater hydrograph in Santa Clara Plain shows annual high groundwater elevations (or low DTW) in the spring, the corresponding subsidence is low in spring. A stress-strain diagram from one spring to the next shows an annual cycle in which the strain usually increases from the spring to the fall and then decreases from the fall to the next spring. Figures 5 and 6 present the stress-strain diagrams using measured data from spring 2016 to spring 2017 at the Sunny and Martha extensometers, respectively. These diagrams demonstrate that the stress and strain in spring 2017 are lower than in spring 2016 at both locations, which means the increased strain from spring to fall 2016 was fully recovered and more by spring 2017, or there was net aquifer expansion from spring 2016 to spring 2017. These diagrams also show that the stress decreased (or water levels increased) most of the time from spring 2016 to spring 2017, especially at the Martha site. This trend is consistent with measured water levels at subsidence index wells. The net aquifer expansion was observed from end of year (EOY) 2016 to EOY 2017 at both the Sunny and Martha extensometer sites.

Continuous monitoring at extensometer sites provides data for ongoing analysis of subsidence conditions, which supports groundwater operation decisions throughout the year. The analysis of extensometer data shows that the 11-year average annual land subsidence from 2007 to 2017 meets the District's tolerable rate of 0.01 feet/year.

Benchmark survey data analysis

The benchmark survey data along the Los Altos, Alum Rock, and Guadalupe CVLCs are used to study spatial land subsidence conditions and annual changes throughout the Santa Clara Plain. The benchmark survey is conducted in the fall of each year. Figure 1 shows benchmark locations along the three CVLCs surveyed in 2017. Related analysis is summarized below.

Change in land surface elevation from 2016 to 2017: As discussed above, 2017 groundwater elevations were rising throughout the Santa Clara Plain. Figure 7 shows the annual change of land surface elevation

from 2016 to 2017 at benchmarks along the Los Altos, Alum Rock, and Guadalupe circuits. For benchmark survey data, a positive value indicates an increase in land surface elevation (uplift) and a negative value indicates a decrease (subsidence). The annual change of land surface elevation from 2016 to 2017 shows the uplift at most of benchmark locations, while the subsidence at a few benchmark locations in the center of Santa Clara Plain groundwater area.

2017 survey data showed a trend of positive land surface elevation changes from 2016 at most the benchmarks. Table 2 summarizes the average and range of annual change of land surface elevation from 2016 to 2017. The average annual change of land surface elevation in 2017 is positive, indicating uplift for all three CVLCs. The risk of land subsidence of 2017 was lower than 2016.

Table 2. Fall 2017 change in land surface elevation compared to fall 2016

Survey Circuit	Average	Range	Number of Benchmarks
	(ft)	(ft)	
Los Altos	0.04	0.00 to 0.09	40
Alum Rock	0.02	-0.01 to 0.06	53
Guadalupe	0.01	-0.01 to 0.03	50

Note: Benchmark survey measures land surface elevation, a positive value indicates an increase in land surface elevation (uplift) and a negative value indicates a decrease (subsidence)

Change in land surface elevation during the drought: Figure 8 presents the cumulative change of land surface elevation from 2012 to 2017. The cumulative change in Figure 8 is positive at most benchmarks. The positive values indicate the land subsidence observed during the recent drought (2012 to 2015) has fully recovered. The recovery is shown at benchmarks representing many areas throughout the Santa Clara Plain, except for few localized areas that show net land subsidence between 2012 and 2017.

Longer-term change in land surface elevation: The average annual change of land surface elevation in the last 11 years from 2007 to 2017 at individual benchmarks is presented in Figure 9. Although land surface elevations moved up or down at higher values in some of the years at some benchmarks, the average annual change at majority of the benchmarks was within the range of -0.01 to 0.01 feet/year. Figure 10 shows the average annual change of land surface elevation at all benchmarks in the last 11 years from 2007 to 2017. During the last 11-year period, there were six years with positive values (uplift) and five years with negative values (subsidence). The highest annual subsidence was in 2014 and highest annual uplift was in 2016. The average annual ground surface elevation change over the last eleven years is around 0.00 feet, indicating no net change.

In summary, the benchmark survey data show land surface elevation uplift for all three CVLCs corresponding with rebounding groundwater elevations in 2017. At most benchmark locations, the land surface elevation was reaching or exceeding the elevation prior to the recent drought (Figure 8). The risk of land subsidence of 2017 was lower than 2016. The average annual change of land surface elevation in the last 11 years at all benchmarks is 0.00 feet, which corroborates the extensometer data, and shows that land subsidence has not continued in the Santa Clara Plain, despite the severe drought that ended in early 2017.

Discussion

As shown in Figure 1, the current land subsidence monitoring network consists of two extensometers, 143 benchmarks along three CVLCs, and ten subsidence monitoring wells, covering most of the Santa Clara Plain. The extensometers monitor subsidence conditions at two sites with high-quality subsidence and

water elevation data. The annual survey provides data representing the subsidence condition at benchmarks along three CVLCs. The monitoring of water elevations at subsidence index wells does not provide data to quantify the subsidence condition directly, but the monitoring is straightforward and related data can be used as an indicator for subsidence condition. Since the index wells are located throughout the Santa Clara Plain, the monitoring data reflects regional conditions.

The current District practice of evaluating the land subsidence condition in the Santa Clara Plain is to calculate the average over an 11-year period using subsidence data collected at two extensometers (Sunny and Martha) and compare it with the established, tolerable rate of land subsidence. The tolerable subsidence rate of 0.01 feet/year is based on the arithmetic average of historic subsidence and rebound measured in the Sunny and Martha extensometers for the 11-year period from 1980 to 1990 (GEOSCIENCE, 1991). Re-evaluation of the tolerable subsidence rate may be warranted to ensure the rate remains aligned with local groundwater management goals.

The location of the two extensometers was selected in the early 1960's based on groundwater conditions at that time. As shown in Figures 3 and 4, the data shows land uplift at Sunny and land subsidence at Martha from 1980 to 2017. The current groundwater elevation at Sunny is above the land surface (artesian), in comparison to the groundwater elevation below the land surface at Martha. Both subsidence and water elevation data indicate pumping activity at Sunny has been reduced significantly in the past thirty plus years. Because the average subsidence is calculated using both extensometers, the subsidence condition may be underestimated because higher subsidence has been observed at Martha. Although the continued subsidence and water elevation monitoring at current extensometer sites will provide consistently high-quality land subsidence data, additional extensometers could enhance the monitoring program if resources are available.

The subsidence thresholds established at ten index wells are used as the minimum water elevations that should be maintained to avoid further inelastic land subsidence. Although the thresholds were established more than twenty years ago, they were based on a thorough study of historical data, subsidence modeling, and previous studies. It is recommended to continue to use these thresholds for groundwater operations and early indication of potential concerns. Because these thresholds are based on the 0.01 feet/year tolerable subsidence rate, they should be re-evaluated if the tolerable subsidence rate changes or if other information indicates a change is warranted.

The annual survey at benchmarks provides direct measurement of land surface changes along three CVLCs in the Santa Clara Plain. However, there are no established criteria to evaluate the survey data. It is recommended to initiate a study to establish a tolerable or allowable subsidence rate for the survey data analysis. This study could be combined with the tolerable/allowable rate for extensometer data.

CONCLUSIONS

In summary, the data measured by each component of the subsidence monitoring network shows that:

- Uplift (or aquifer expansion) was measured at both extensometer sites in 2017. The average annual subsidence rate over the last 11 years at the Martha and Sunny sites is 0.001 feet/year, which is less than the District's tolerable rate of 0.01 feet/year.
- The average water elevations in 2017 were higher than that in 2016 at all ten subsidence index wells. The water elevation recovery was observed throughout the Santa Clara Subbasin. Groundwater elevations were higher than the subsidence thresholds at all ten index wells in 2017 in the Santa Clara Plain.

- The benchmark survey data showed that the land surface elevation in 2017 was generally higher than 2016, indicating a land surface uplift, and that the average annual change of land surface elevation over last 11 years was 0.00 feet (no net change).

The analysis of the data collected through the District subsidence monitoring network indicates that the risk of land subsidence in 2017 was low, and that it was lower than 2016. The impacts of the 2012 to 2015 drought on land subsidence have been alleviated, as data shows that the groundwater elevations in 2017 were on the rise and close to historical highs and the land surface elevations in 2017 were higher than 2012 at most benchmarks. Continued monitoring of the subsidence network is recommended to detect early signs of inelastic land subsidence and to support sustainable groundwater management.

REFERENCES

1. GEOSCIENCE Support Services Incorporated, Subsidence Threshold in the North County Area of Santa Clara Valley, 1991.
2. Santa Clara Valley Water District (SCVWD), 2016 Groundwater Management Plan for the Santa Clara and Llagas Subbasins, December 2016.
3. SCVWD, 2016 Subsidence Data Analysis, Technical Memorandum, March 2017.

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Figure 1. Map of the District subsidence monitoring network

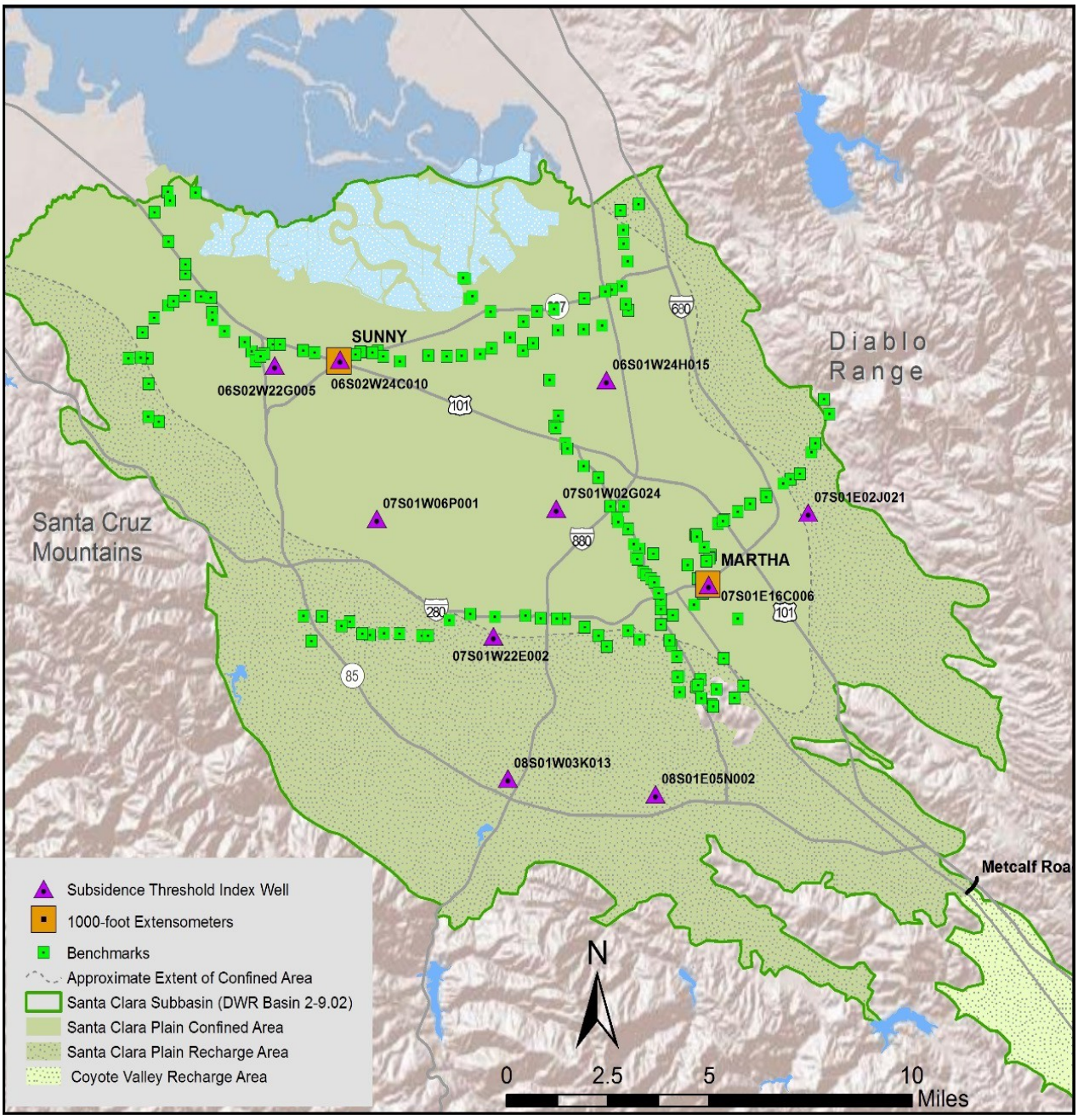
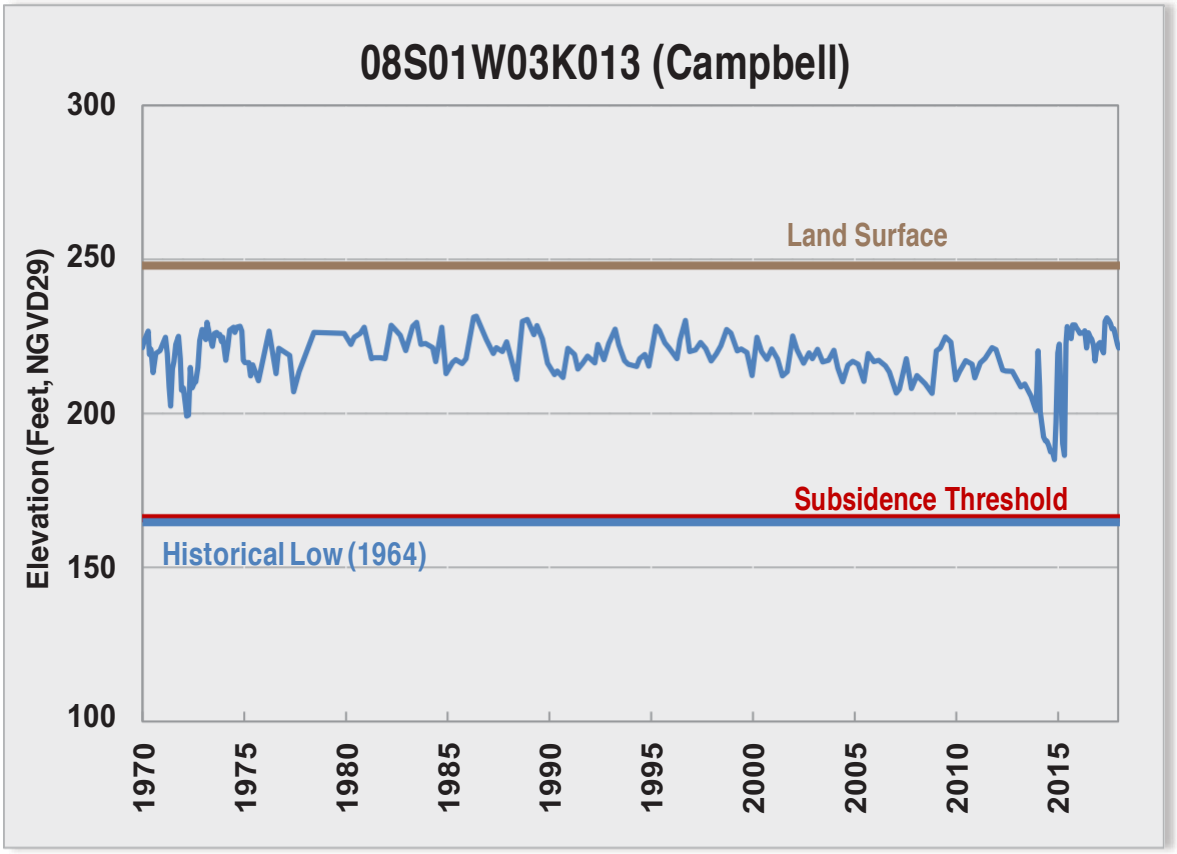


Figure 2. Measured groundwater elevation at subsidence index wells



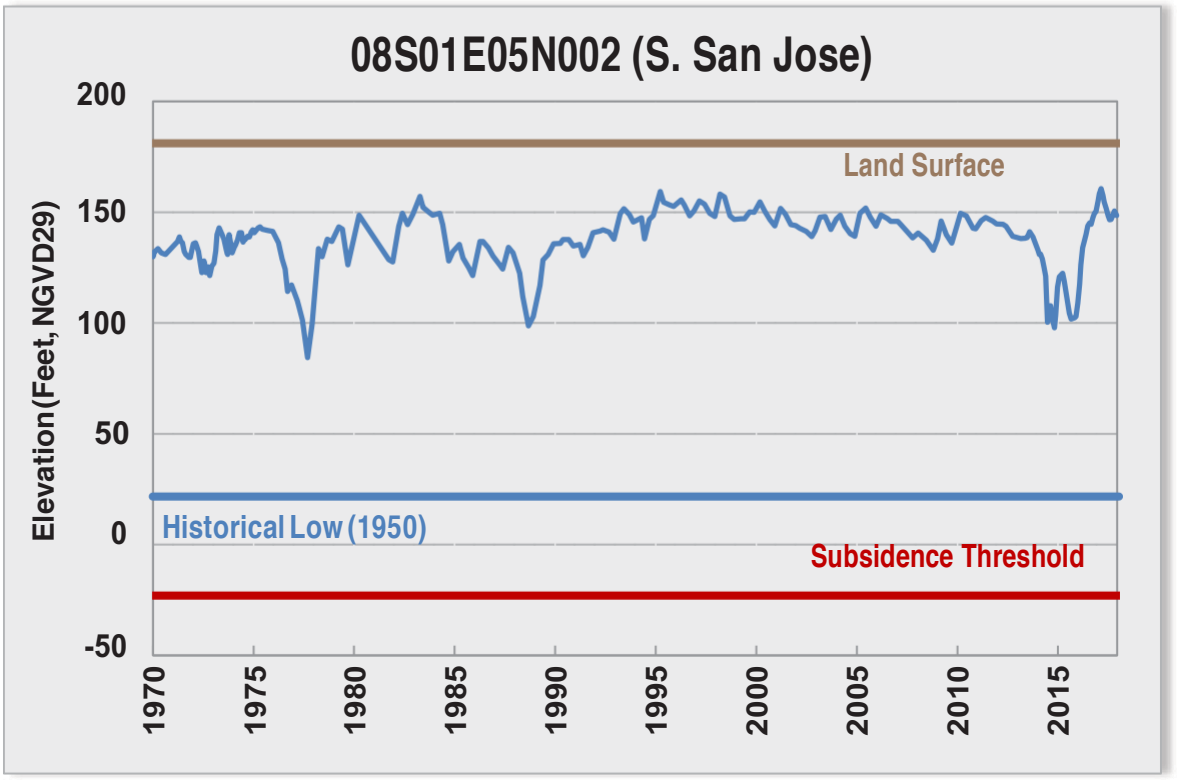
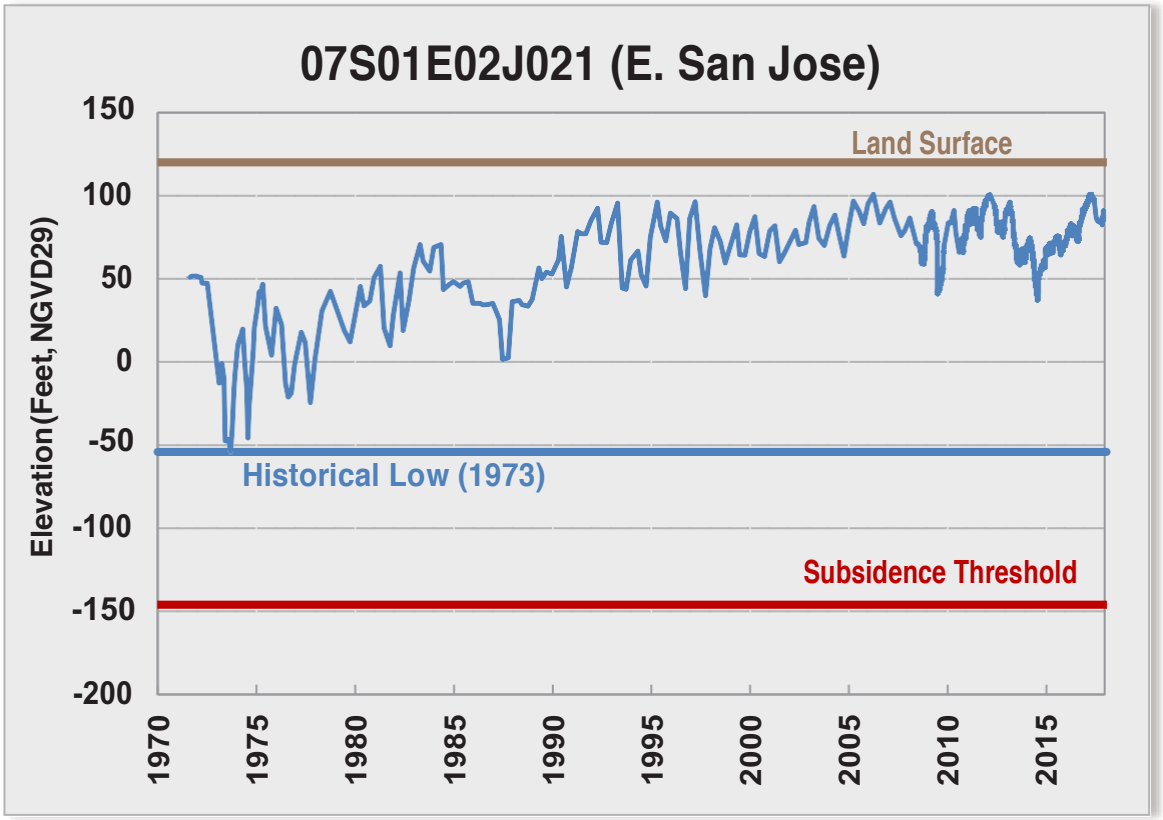


Figure 2. Measured groundwater elevation at subsidence index wells (continued)



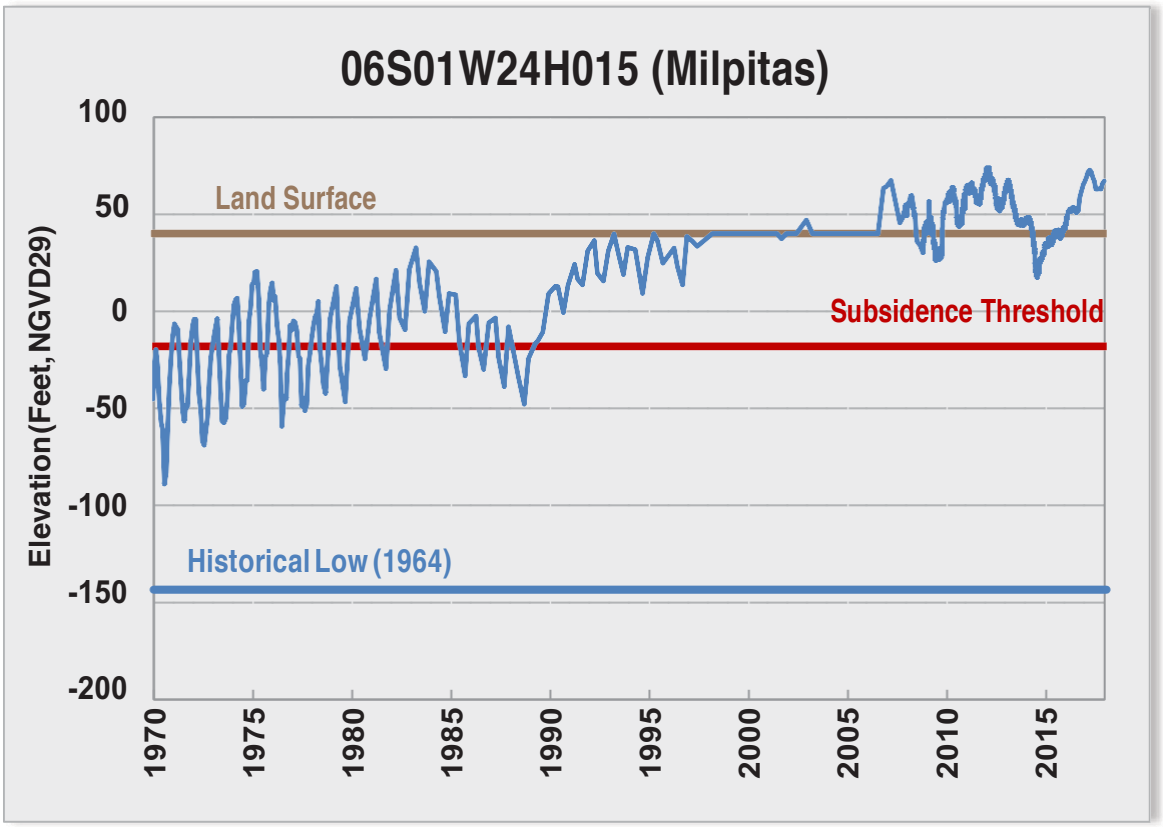
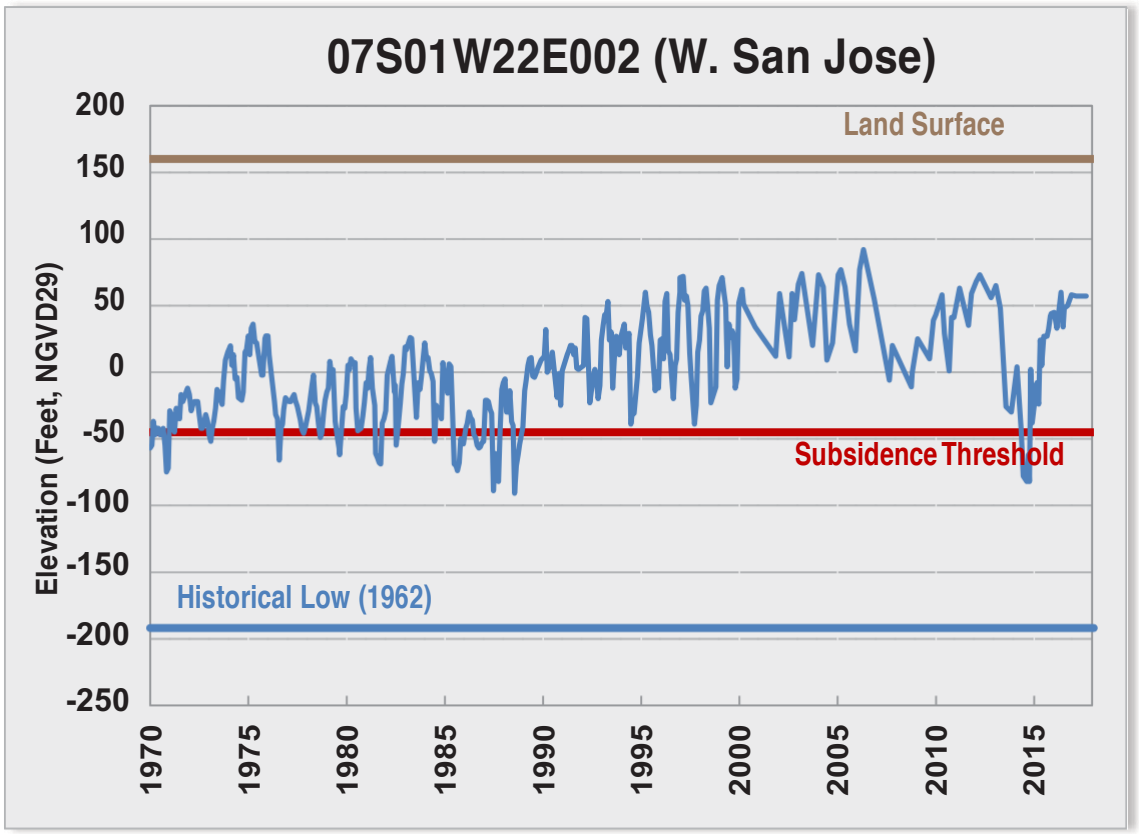


Figure 2. Measured groundwater elevation at subsidence index wells (continued)



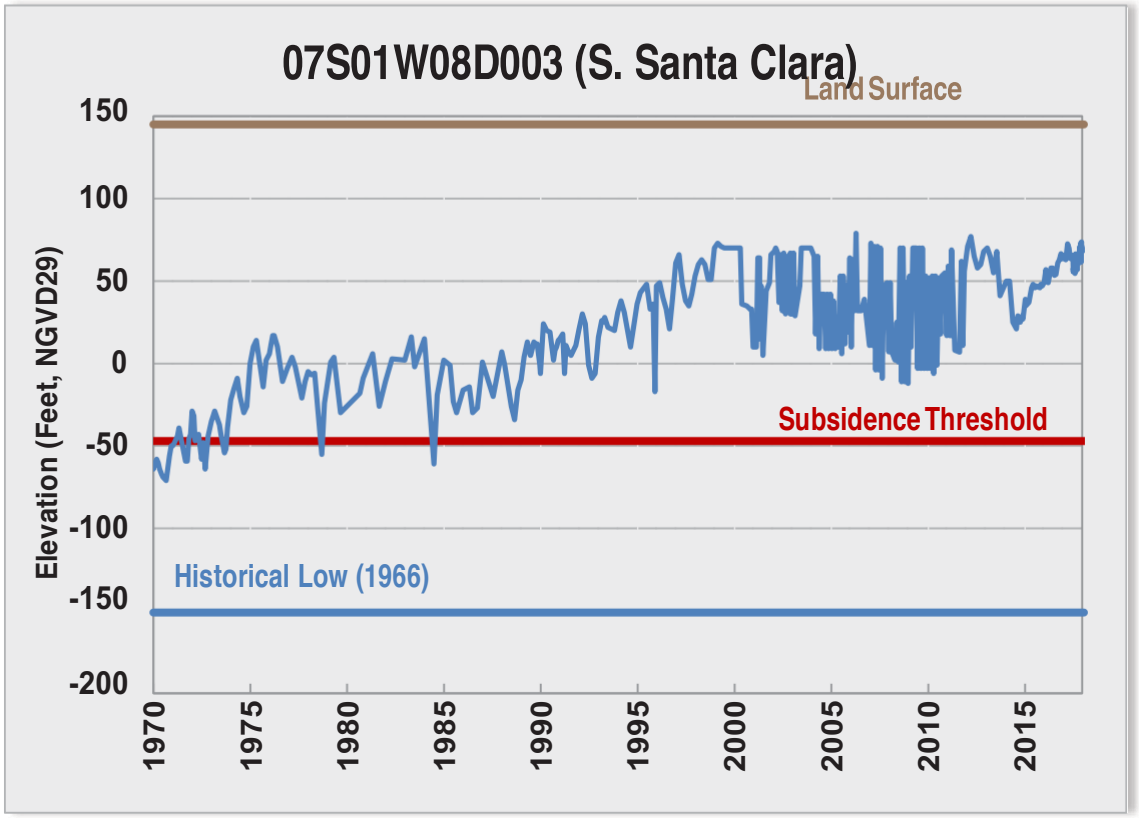
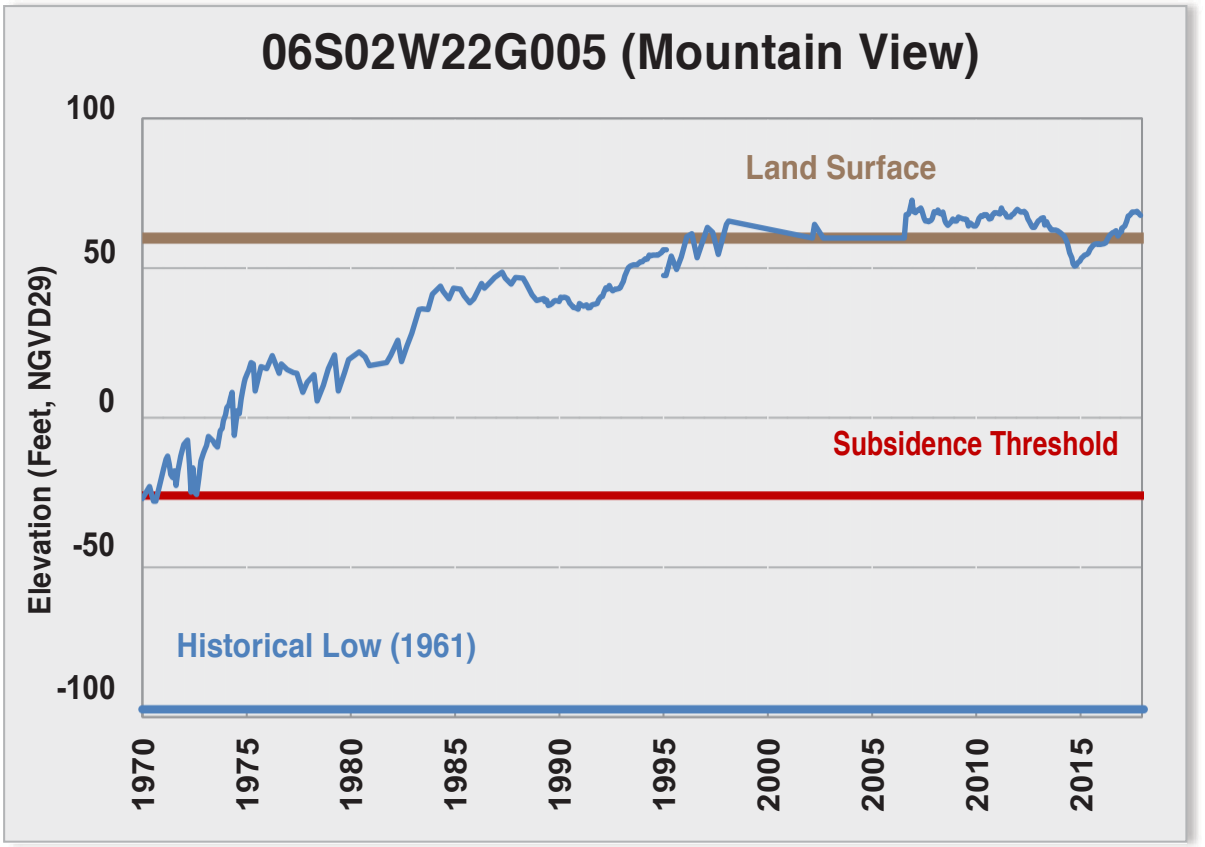


Figure 2. Measured groundwater elevation at subsidence index wells (continued)



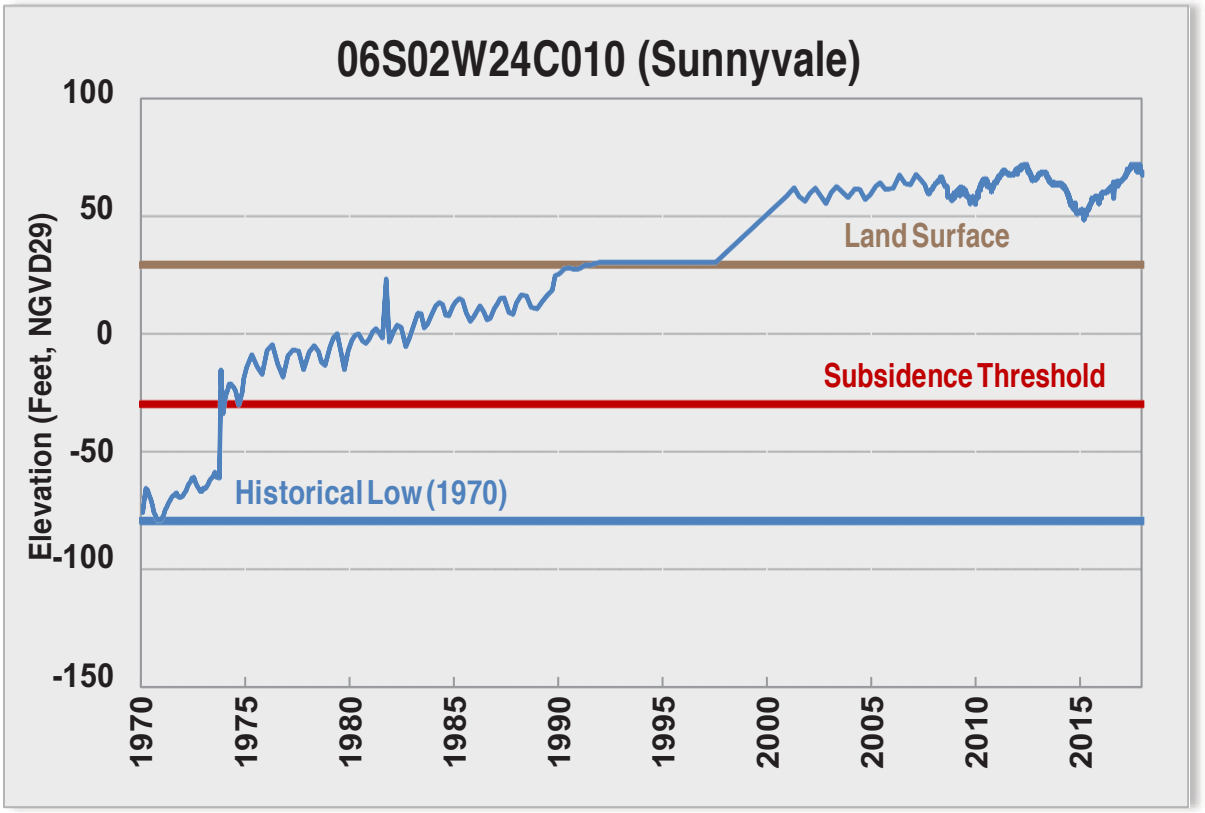
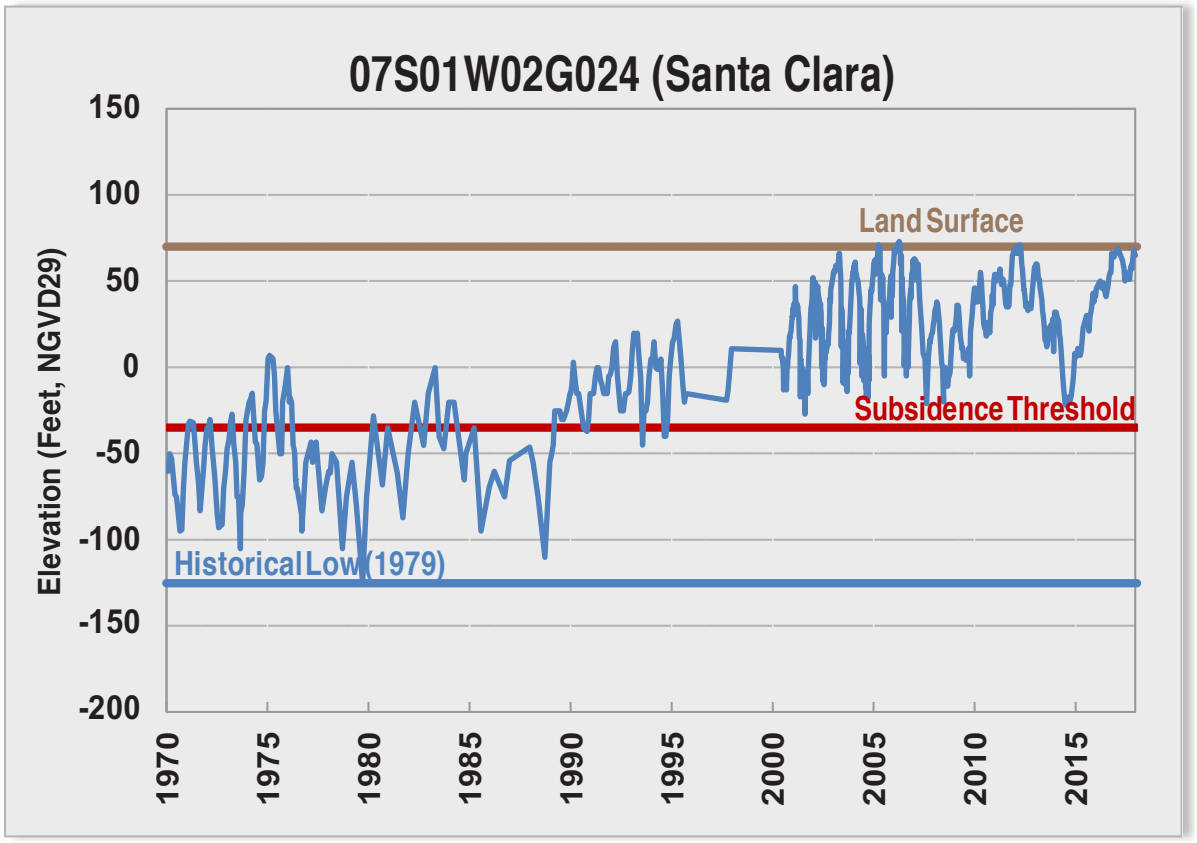


Figure 2. Measured groundwater elevation at subsidence index wells (continued)



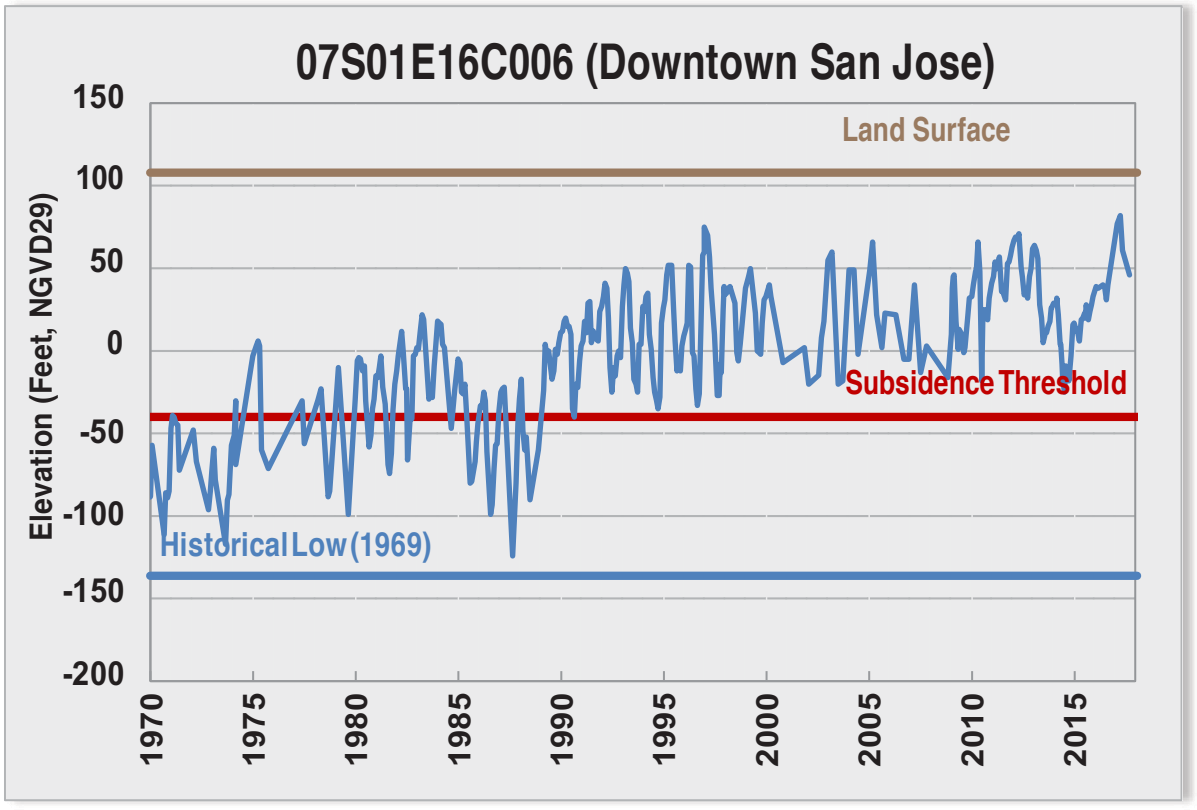


Figure 3. Measured depth to water and compaction at the Sunnyvale (Sunny) extensometer

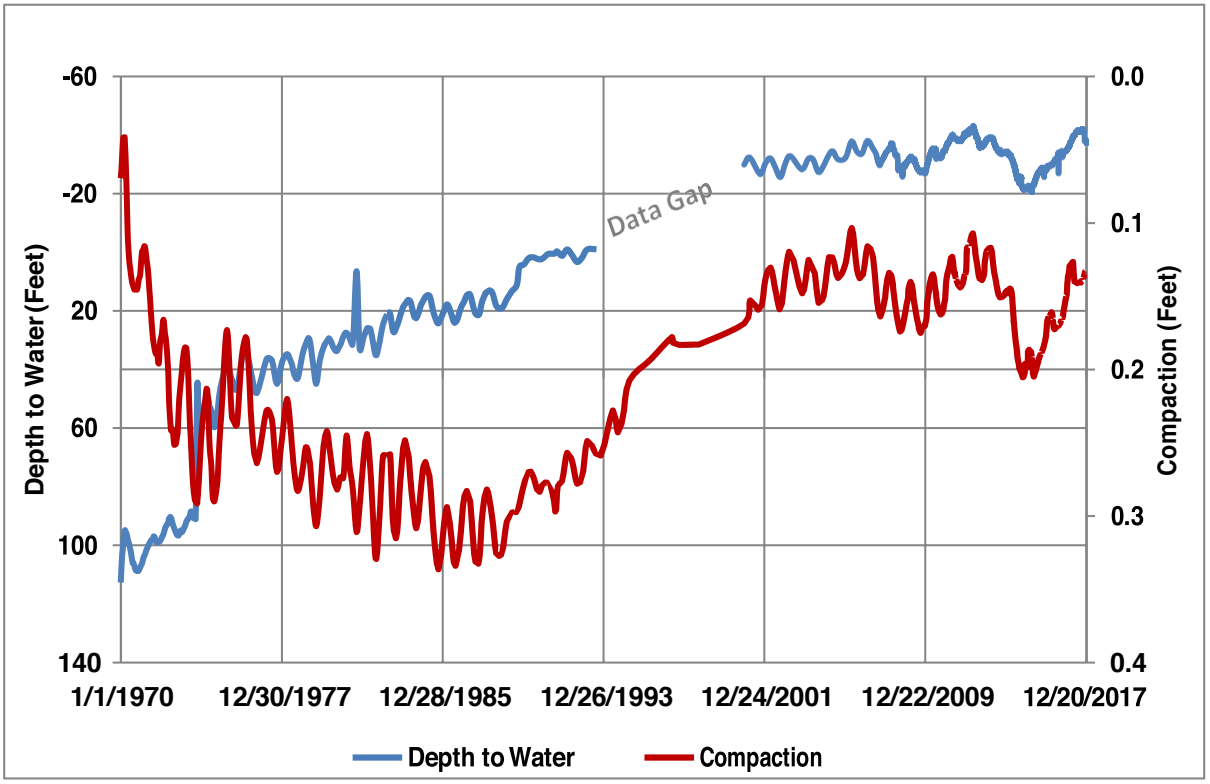


Figure 4. Measured depth to water and compaction at the San Jose (Martha) extensometer

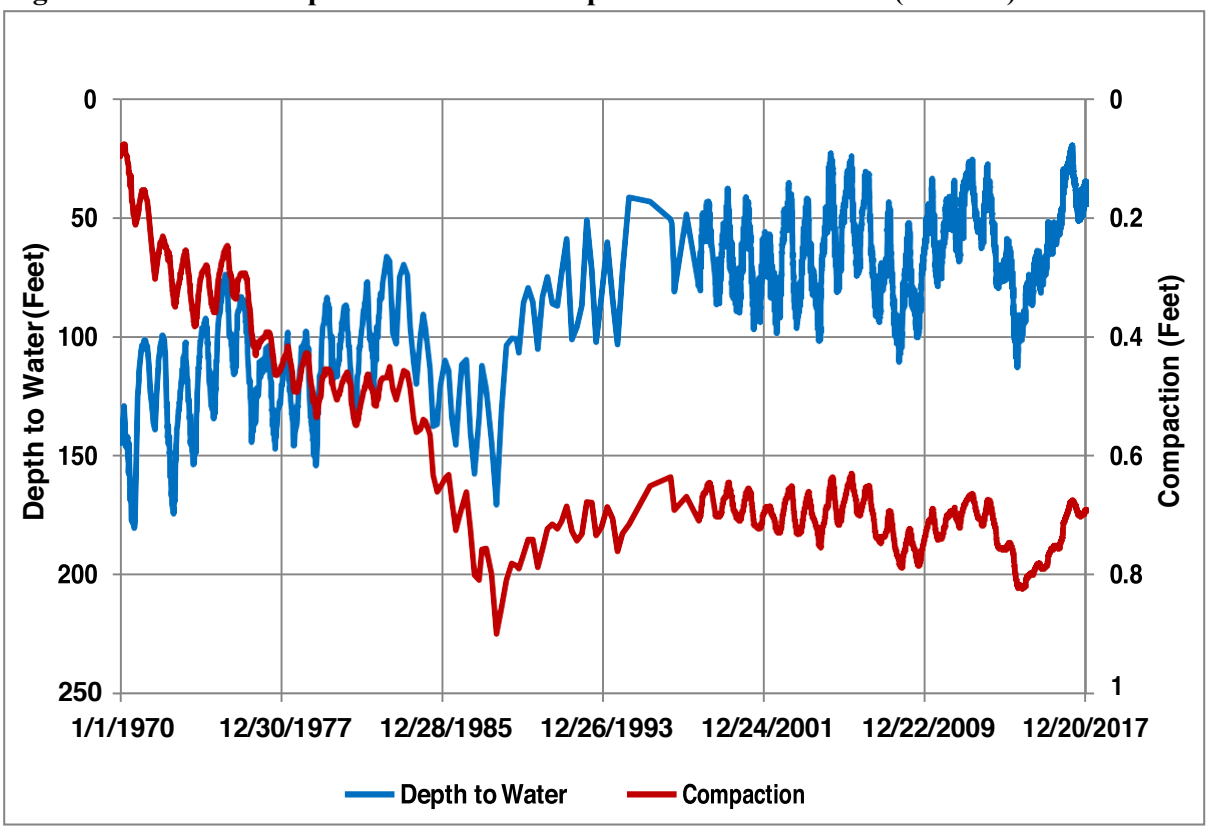


Figure 5. **Stress-strain (depth to water vs. compaction) from spring 2016 to spring 2017 at the Sunnyvale (Sunny) extensometer**

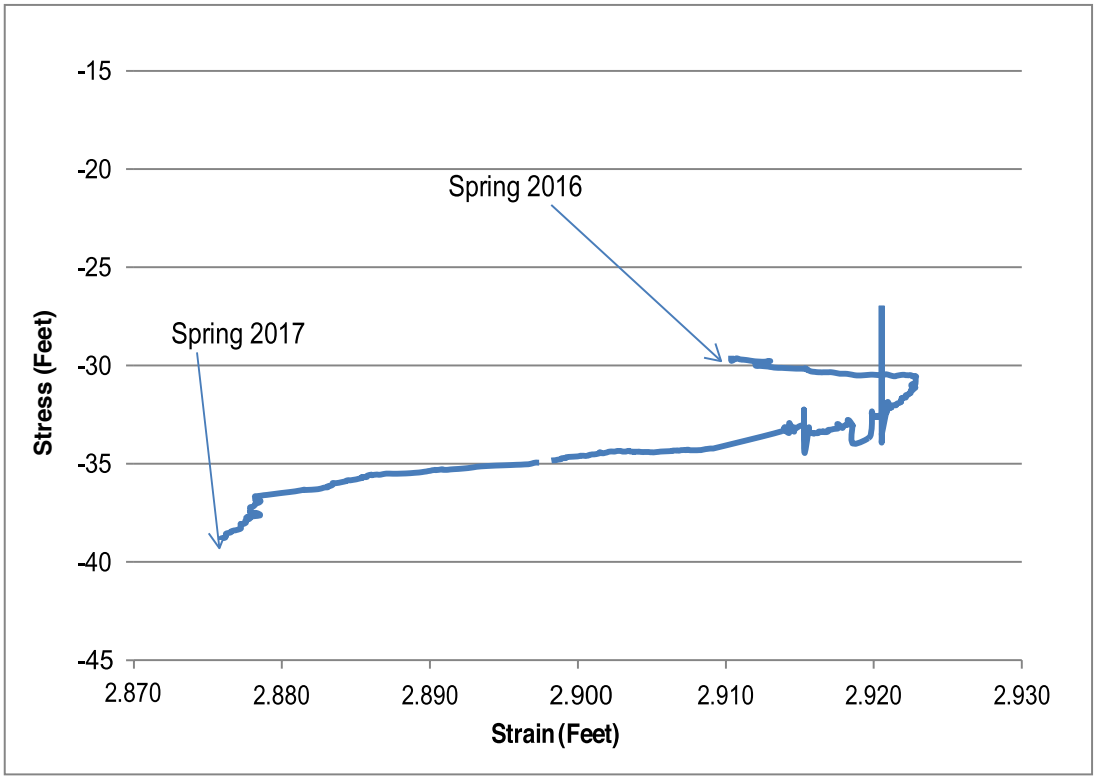


Figure 6 **Stress-strain (depth vs. compaction) from spring 2016 to spring 2017 at the San Jose (Martha) extensometer**

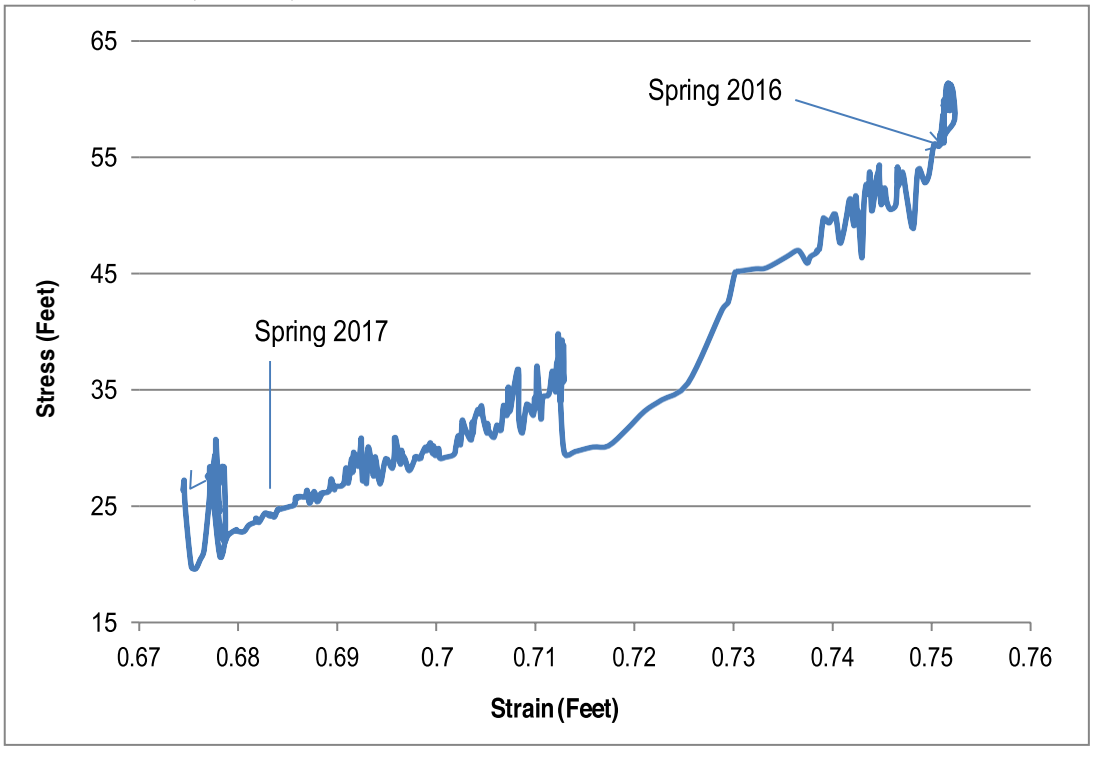


Figure 7. **Change of land surface elevation between 2016 and 2017 along three circuits (shown from west to east for Los Altos and Alum Rock, and north to south for Guadalupe, positive values indicate land uplift)**

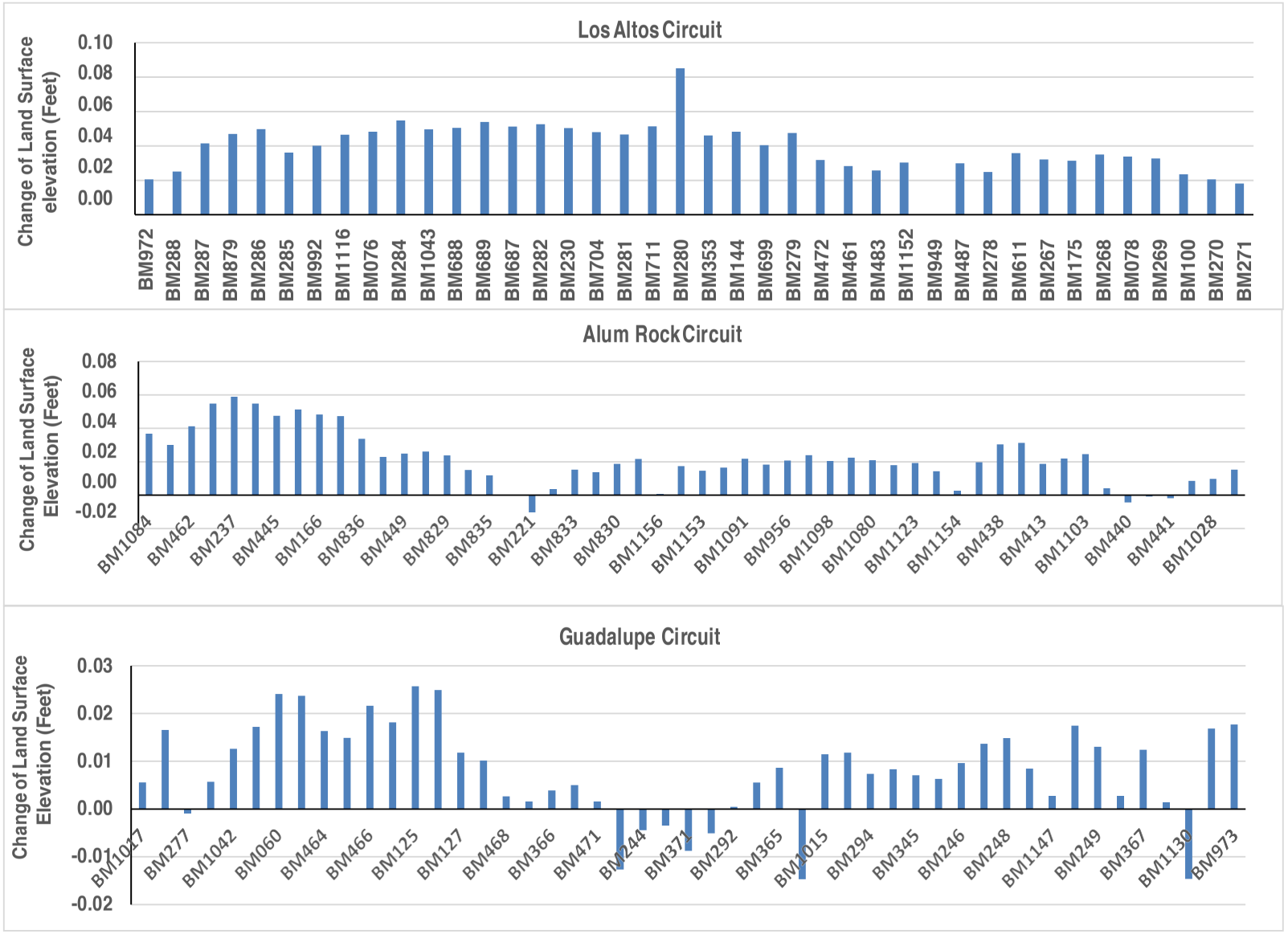


Figure 8. **Cumulative change of land surface elevation from 2012 to 2017 along three circuits (shown from west to east for Los Altos and Alum Rock, and north to south for Guadalupe, positive values indicate land uplift)**

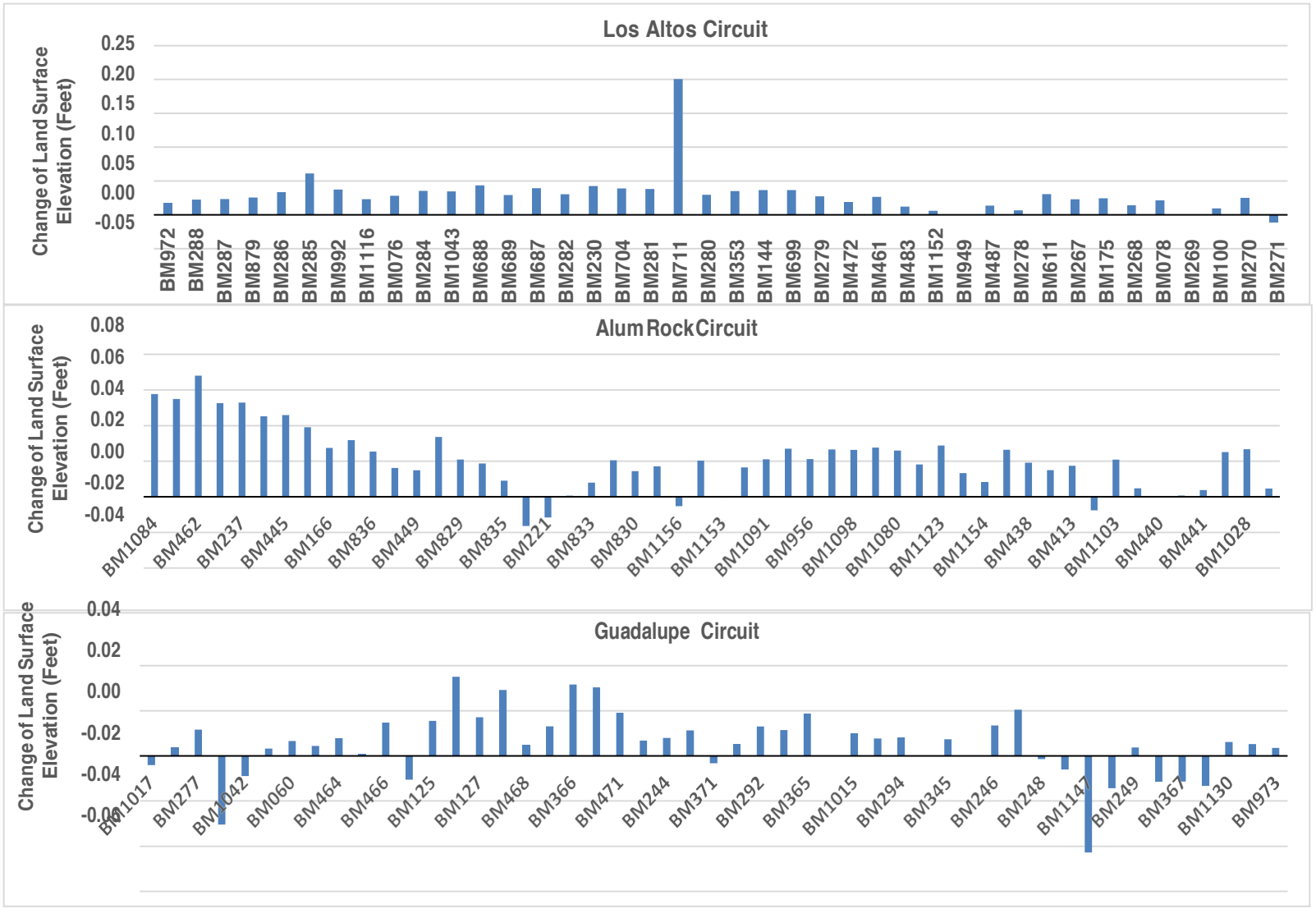


Figure 9. **Average annual change of land surface elevation from 2007 to 2017 along three circuits (shown from west to east for Los Altos and Alum Rock, and north to south for Guadalupe, positive values indicate land uplift)**

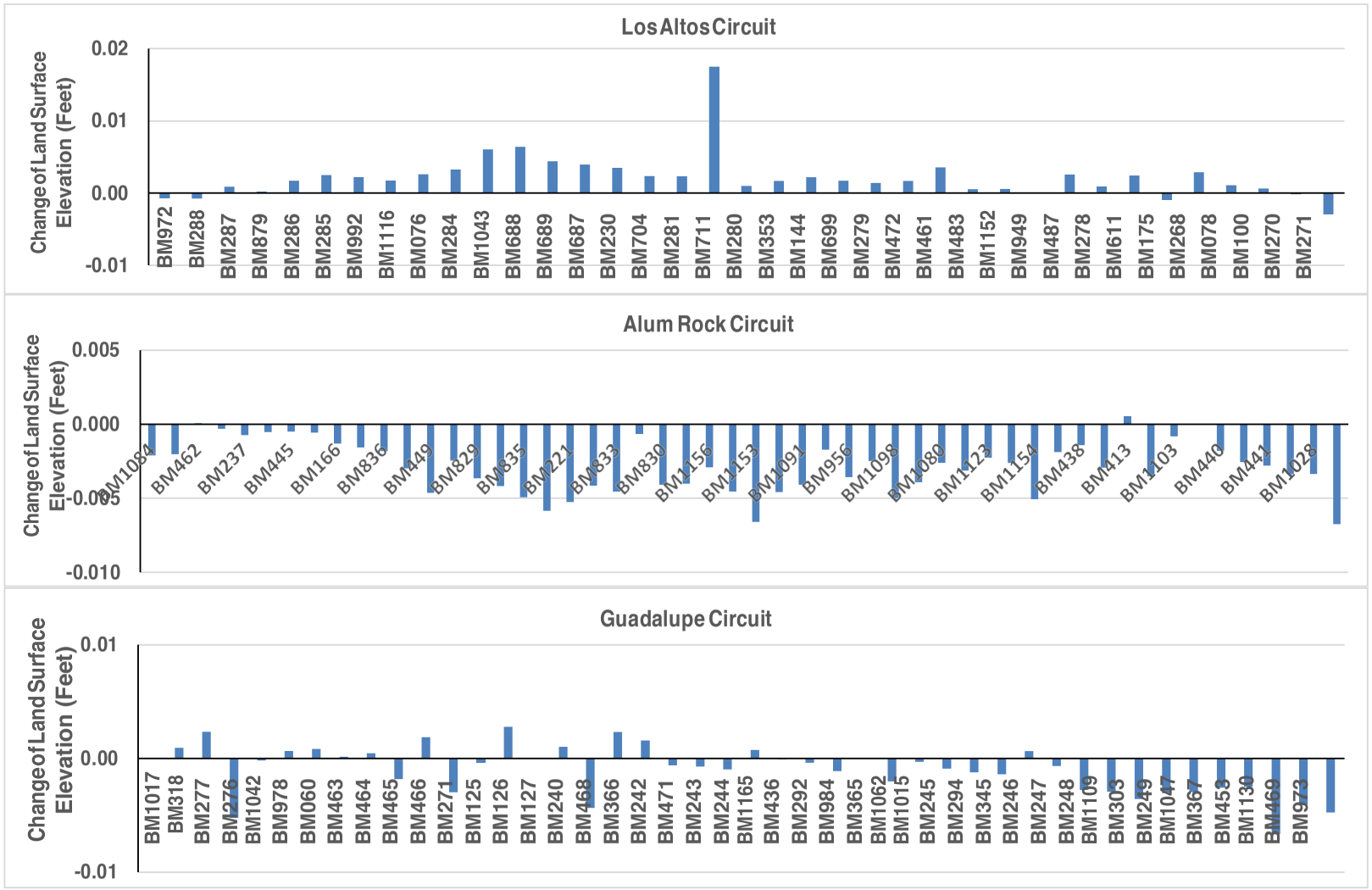
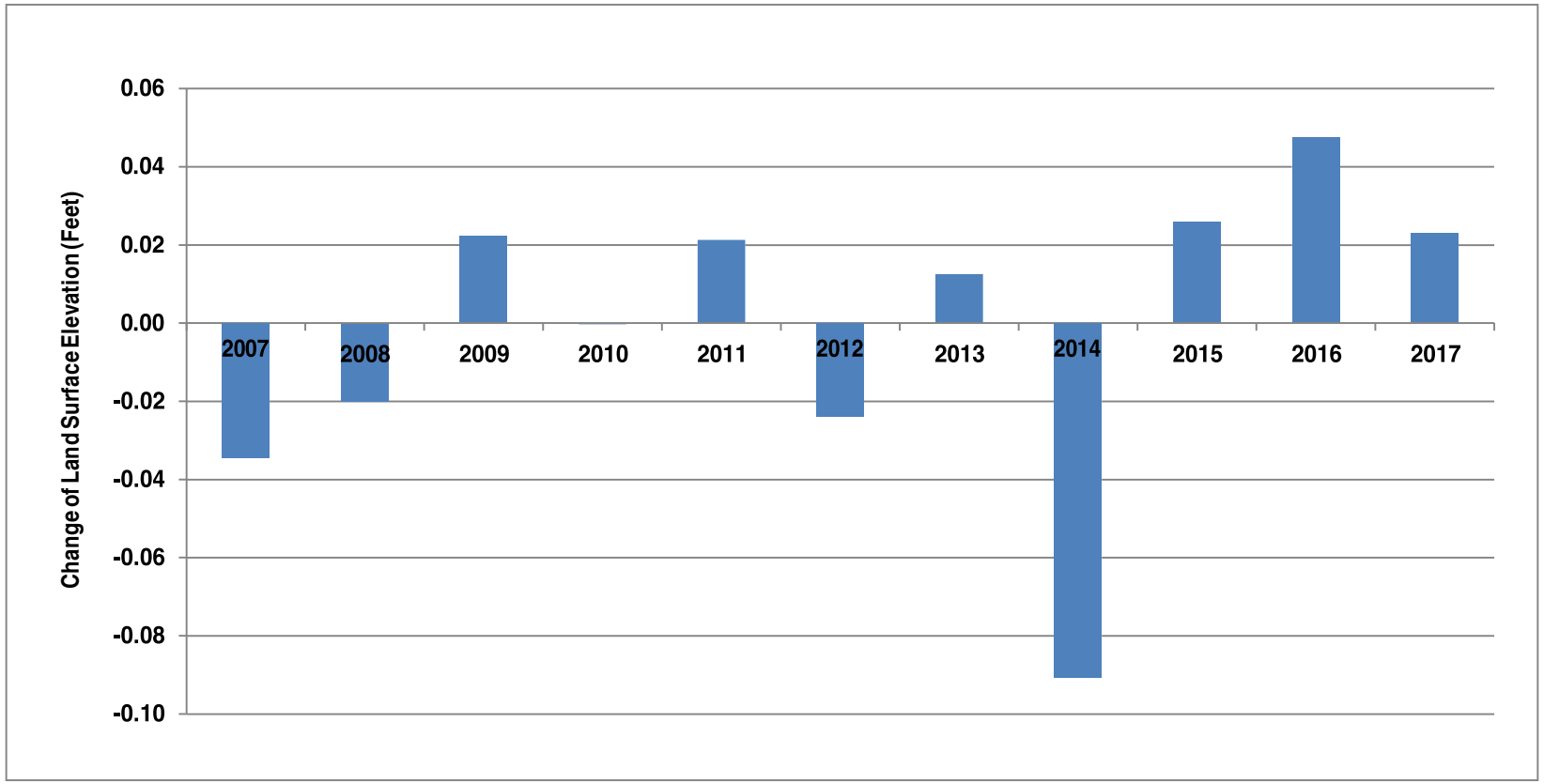
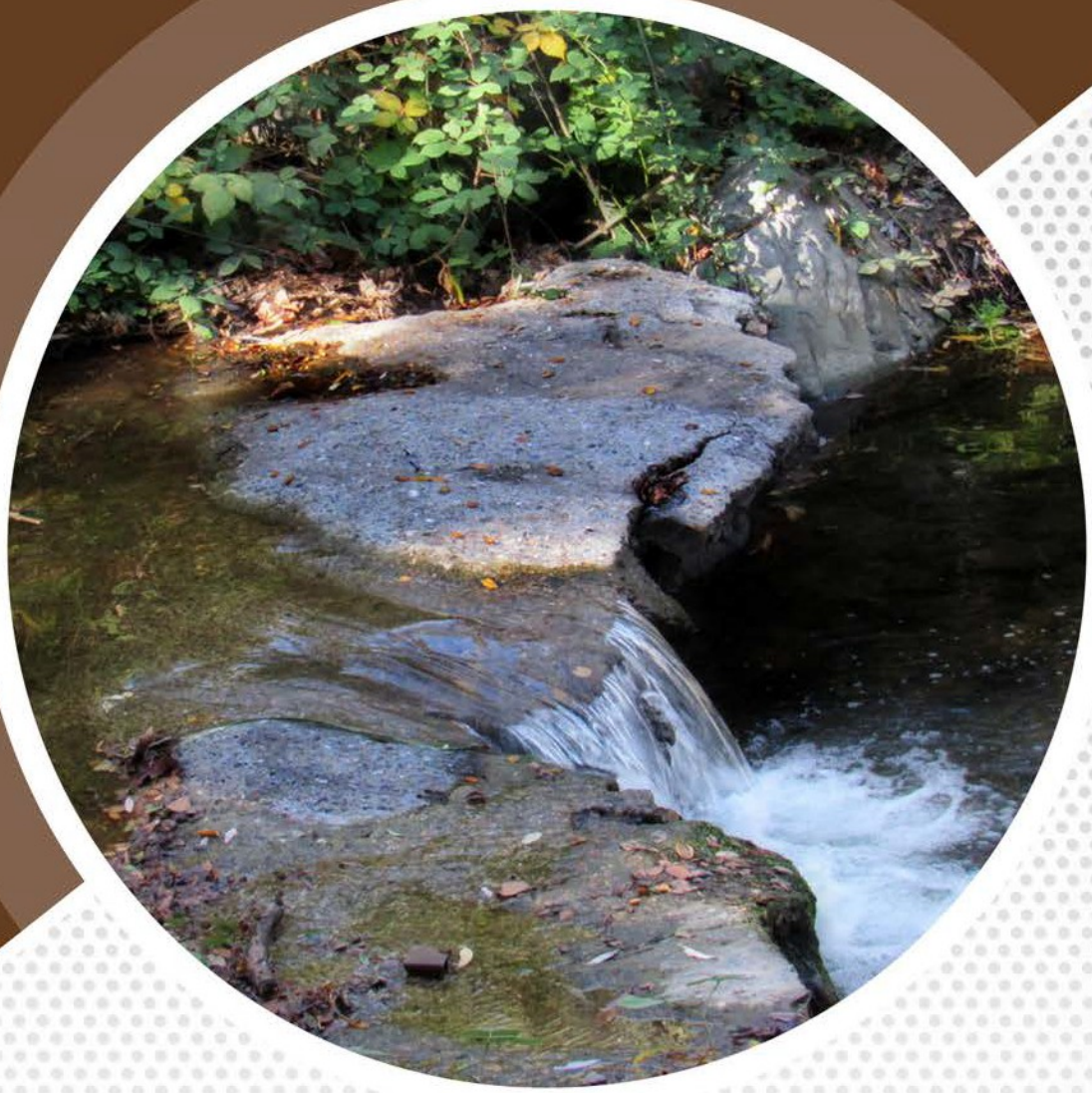


Figure 10. **Average annual change of land surface elevation along the three circuits from 2007 to 2017 (positive values indicate land uplift)**



Appendix B

2017 Groundwater Quality Summary Provided to Well Owners



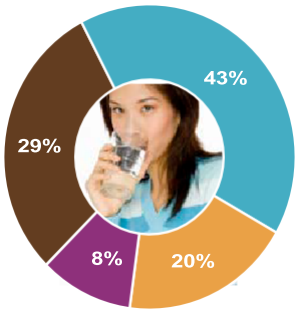
Annual Groundwater Quality Summary Report

For Testing Performed in 2017

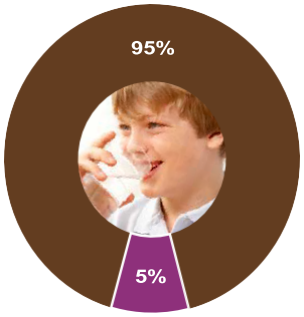
Santa Clara Valley Water District

Protecting our Groundwater

NORTH COUNTY WATER USE



SOUTH COUNTY WATER USE



- Groundwater
- Treated Water
- Hetch-Hetchy
- Other Local and Recycled Water

Groundwater is an essential local water resource, providing about half of the water used in Santa Clara County each year. In some areas, groundwater is the only source of drinking water. Protecting our groundwater helps ensure that adequate supplies are available now and in the future.

The Santa Clara Valley Water District works to safeguard groundwater by:

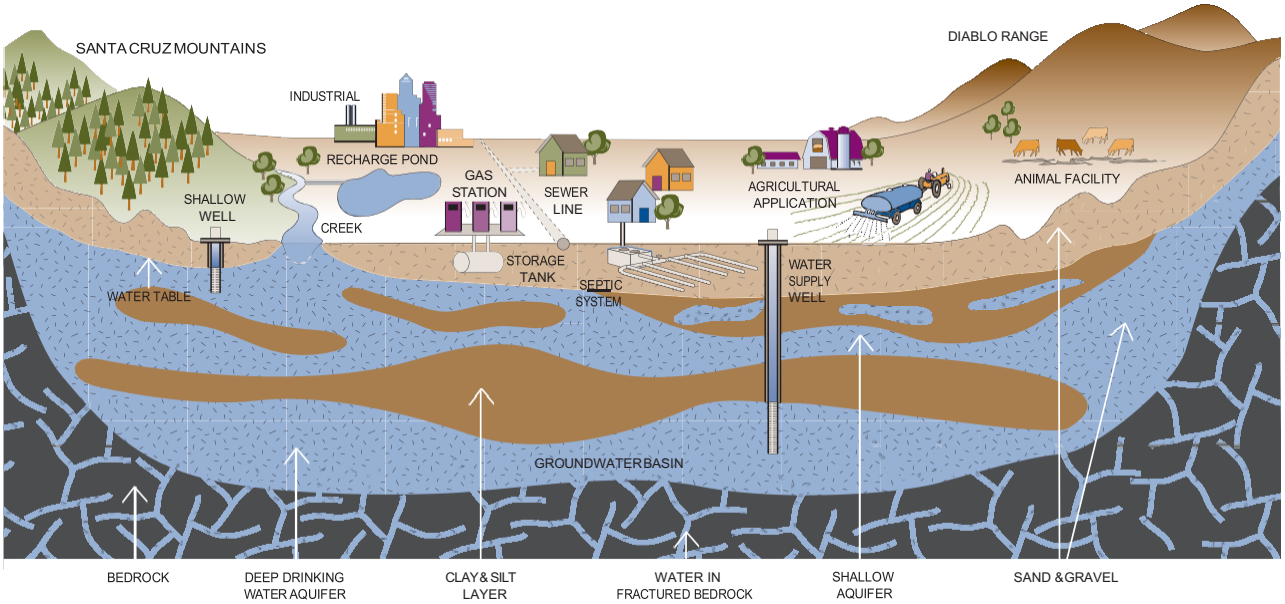
- Replenishing groundwater basins with local and imported surface water.
- Reducing demands on groundwater through the delivery of treated water, water conservation, and water recycling.
- Monitoring groundwater and conducting programs to protect against contamination.

Well water testing throughout the county indicates that groundwater quality is generally very good. All drinking water, including bottled water, trail closure, contains small amounts of some contaminants. As water travels over the surface of the land and through the ground, it dissolves naturally occurring minerals and can pick up substances from animal and human activities.

Contaminants that may be present in groundwater include:

- Microbial contaminants such as viruses and bacteria that may come from sewage treatment plants, sewer lines, septic systems, agricultural operations, and wildlife.
- Inorganic contaminants such as salts and metals that can be naturally occurring or result from industrial or domestic wastewater discharges, animal facilities, farming, and mining.
- Insecticides, herbicides, and fertilizers, that may come from agriculture, and residential uses.
- Organic chemicals from industrial processes, gas stations, dry cleaners, agricultural application, and septic systems.
- Radioactive contaminants that are naturally occurring in our area.

The presence of contaminants does not necessarily indicate that water poses a health risk. State and federal drinking water standards identify maximum contaminant levels that relate to health risk.



2017 Groundwater Quality Summary

Monitoring conirms generally high groundwater quality, but South County nitrate is a concern

In 2017, the water district sampled over 290 domestic wells and evaluated data from another 225 public water supply wells in North and South County (see map on back page). Nearly all wells tested meet drinking water standards with the notable exception of nitrate in some South County domestic wells. The water district works with regulatory and land use agencies on this ongoing challenge.

The table below summarizes the results for any substance detected in a domestic or public water supply well in 2017; not every well was tested for all substances listed. Although Maximum Contaminant Levels (MCLs) apply only to public water systems, MCLs are helpful in understanding results from domestic wells. Please note this regional summary may not reflect the water quality in every well since each property and well is unique.

Primary Drinking Water Standards – Public Health Related Standards Inorganic Contaminants	Units	Maximum Contaminant Level	Public Health Goal	North County Medium	North County Range	South County Medium	South County Range	Typical Sources
Aluminum	ppb	1,000	600	3.18	ND - 1,700	11.1	ND - 820	Erosion of natural deposits
Antimony	ppb	6	1	ND	ND	ND	ND - 9.9	Discharge from petroleum reineries; ire retardants; ceramics; electronics; solder
Arsenic	ppb	10	0.004	ND	ND - 4	ND	ND - 4	Erosion of natural deposits; glass and electronics production waste
Asbestos	MFL	7	7	ND	ND - 0.7	2.99	ND - 18	Erosion of natural deposits
Barium	ppb	1,000	2,000	135	ND - 310	97.9	ND - 300	Erosion of natural deposits
Chromium (total)	ppb	50	--	1.10	ND - 1.7	1.20	ND - 3.8	Erosion of natural deposits; metal plating
Chromium-6 (hexavalent)	ppb	--	0.02	2.20	ND - 7.9	4.00	ND - 7.8	Erosion of natural deposits; metal plating and industrial discharges
Fluoride	ppm	2	1	0.141	ND - 0.84	0.150	ND - 1.06	Erosion of natural deposits
Mercury	ppb	2	1.2	ND	ND - 1.9	ND	ND	Erosion of natural deposits; discharge from reineries and factories; runoff from landills and cropland
Nickel	ppb	100	12	1.20	ND - 16	ND	ND - 4.5	Erosion of natural deposits; discharge from metal industries
Nitrate + Nitrite (as N)	ppm	10	10	2.40	ND - 6.1	3.40	0.41 - 7.1	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
Nitrate (as N)	ppm	10	10	3.00	ND - 29.2	6.13	0.06 - 73.7	Runoff and leaching from fertilizer use; leaching from septic tanks and sewage; erosion of natural deposits
Perchlorate	ppb	6	1	ND	ND	ND	ND - 4.5	Solid rocket propellant, ireworks, explosives, flares, matches, and a variety of industries
Selenium	ppb	50	30	6	ND - 11	ND	ND - 5	Erosion of natural deposits
Radioactive Contaminants								
Gross Alpha	pCi/L	15	--	2	ND - 8.3	ND	ND - 0.43	Erosion of natural deposits
Gross Beta	mrem/yr	4	--	--	--	0.148	0.148	Erosion of natural deposits
Radium 226	pCi/L	--	0.05	ND	ND	0.128	0.128	Erosion of natural deposits
Tritium	pCi/L	20,000	400	--	--	170	170	Erosion of natural deposits
Uranium	pCi/L	20	0.43	ND	ND	0.294	0.294	Erosion of natural deposits
Volatile Organic Chemicals								
1,1,1-Trichloroethane (1,1,1-TCA)	ppb	200	1,000	ND	ND - 1.2	ND	ND	Discharge from metal degreasing sites and other industrial processes
1,1-Dichloroethene (1,1-DCE)	ppb	6	10	ND	ND - 0.87	ND	ND	Discharge from industrial processes
Haloaccetic Acids (HAA5)	ppb	60	--	4.40	4.40	--	--	Drinking water chlorination
Tetrachloroethene (PCE)	ppb	5	0.06	ND	ND	ND	ND - 2.2	Discharge from industrial processes, dry cleaners, and automotive repair
Total Trihaloethanes (THMs)	ppb	80	--	ND	ND - 21.2	ND	ND - 1.6	Drinking water chlorination
Microbiological Contaminants[1]				Present	Absent	Present	Absent	Typical Sources
E. Coli Bacteria		--	--	4	23	5	263	Human and animal fecal waste
Total Coliform Bacteria		--	--	11	16	91	177	Naturally present in the environment

Notes: 1) The table shows the number of domestic wells tested that had bacteria present or absent. Public water systems are required to ensure that fewer than 5% of samples have total coliform present and that no samples have e.coli present. Domestic wells are not subject to these standards.

Terms and Definitions

Color units: A measure of color in water

Maximum Contaminant Level (MCL): The highest level of a contaminant allowed in public water systems. Primary MCLs are set as close to PHGs as is economically and technologically feasible. Secondary MCLs protect the odor, taste, and appearance of drinking water.

Median: The "middle" value of the results, with half of the values above the median and half of the values below the median.

MFL: Million Fibers per Liter

mrem/yr: Millirems per year

ND: Not detected (at laboratory testing limit)

NTU: Nephelometric Turbidity Units

pCi/L: picoCuries per liter (a measure of radiation)

-- Indicates there is no related drinking water standard, or that the substance was not tested.

ppm: parts per million (milligrams per liter)

ppb: parts per billion (micrograms per liter)

Public Health Goal (PHG): The level of a contaminant in drinking water below which there is no known or expected risk to human health. PHGs are set by the California EPA.

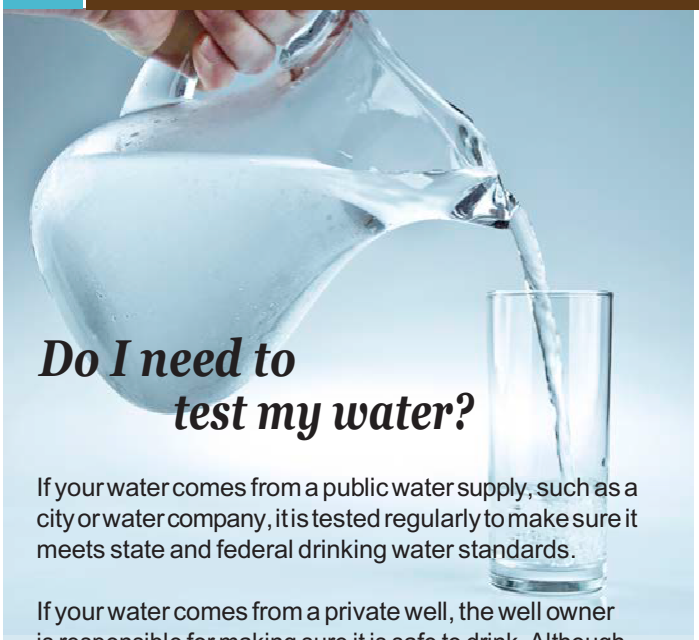
TON: Threshold Odor Number

uS/cm: microSiemens per centimeter (a measure of the dissolved inorganic salt content)

2017 Groundwater Quality Summary

Secondary Drinking Water Standards – Aesthetic Standards	Units	Maximum Contaminant Level	Public Health Goal	North County Medium	North County Range	South County Medium	South County Range	Typical Sources
Chloride	ppm	250	--	49.0	13 - 89	46.0	17 - 135	Runoff/leaching from natural deposits; seawater influence
Color	Color Units	15	-	5.00	ND - 31	6.00	ND - 9	Naturally occurring organic materials
Copper[1]	ppb	1,000	300	1.80	1.4 - 120	3.10	ND - 16.6	Internal corrosion of household plumbing systems; erosion of natural deposits
Foaming Agents (MBAS)	ppb	500	--	ND	ND - 0.1	ND	ND	Municipal and industrial waste discharges
Iron	ppb	300	--	51.9	41 - 3,900	2.71	26 - 6,300	Leaching from natural deposits; industrial wastes
Manganese	ppb	50	--	2.69	ND - 240	0.745	ND - 1,200	Leaching from natural deposits; industrial wastes
Odor Threshold	TON	3	--	ND	ND - 1.4	ND	ND	Naturally occurring organic materials
pH	pH units	6.5 - 8.5	--	7.53	6.23 - 8.1	7.75	7.45 - 8	Erosion of natural deposits; carbon dioxide emissions; rainfall
Speciic Conductance	uS/cm	900	--	664	349 - 1,840	655	299 - 2,380	Substances that form ions when in water; seawater influence
Sulfate	ppm	250	--	47.0	3.6 - 196	38.0	ND - 224	Runoff/leaching from natural deposits; industrial wastes
Total Dissolved Solids (TDS)	ppm	500	--	400	270 - 1,100	376	244 - 608	Runoff/leaching from natural deposits
Turbidity	NTU	5	--	0.460	ND - 4.9	0.205	ND - 2	Soil runoff
Zinc	ppb	5,000	--	0.865	ND - 670	4.17	ND - 340	Runoff/leaching from natural deposits; industrial wastes
Other Water Quality Parameters								
Alkalinity (total, as CaCO3)	ppm	--	--	220	120 - 380	179	93 - 344	Atmospheric and vadose zone carbon dioxide
Boron	ppb	--	--	ND	ND - 506	120	ND - 2,000	Erosion of natural deposits
Bromide	ppm	--	--	0.140	ND - 0.49	0.160	ND - 1.56	Erosion of natural deposits; seawater intrusion; sea spray
Bromodichloromethane (THM)	ppb	--	--	ND	ND - 5.5	ND	ND	Drinking water chlorination
Bromoform (THM)	ppb	--	--	ND	ND - 5.4	ND	ND	Drinking water chlorination
Calcium	ppm	--	--	63.0	23.5 - 110	53.1	32.9 - 99.6	Erosion of natural deposits
Carbon dioxide	ppb	--	--	8.13	ND - 240	ND	ND	Atmospheric sources; dissolution of carbonate rocks
Carbonate (as CO3)	ppm	--	--	ND	ND - 2	ND	ND	Atmospheric sources; dissolution of carbonate rocks
Chloroform (THM)	ppb	--	--	ND	ND - 2.74	ND	ND - 1.6	Drinking water chlorination
Cobalt	ppb	--	--	ND	ND - 0.21	ND	ND	Leaching from natural deposits; industrial wastes
DCPA (Total Di & Mono Acid Degradates)	ppb	--	--	ND	ND - 0.7	ND	ND	Herbicide used to control grasses and weeds
Dibromochloromethane (THM)	ppb	--	--	ND	ND - 7.9	ND	ND	Drinking water chlorination
Dichloroacetic Acid	ppb	--	--	2.7	2.7	--	--	Drinking water chlorination
Hardness (total, as CaCO3)	ppm	--	--	290	122 - 636	271	ND - 728	Erosion of natural deposits
Lead[1]	ppb	--	0.2	0.390	ND - 16	ND	ND - 2.35[2]	Erosion of natural deposits; internal corrosion of household water plumbing systems; discharges from industrial manufacturers
Lithium	ppb	--	--	5.60	ND - 25	10.0	ND - 28	Erosion of natural deposits; discharge from industrial uses
Magnesium	ppm	--	--	29.1	8.2 - 67	31.0	17 - 59.2	Erosion of natural deposits
Molybdenum	ppb	--	--	0.900	ND - 5.1	ND	ND - 3.5	Erosion of natural deposits
Monobromoacetic Acid (MBAA)	ppb	--	--	1.7	1.7	--	--	Drinking water chlorination
Orthophosphate	ppm	--	--	0.070	ND - 2.3	ND	ND - 1.56	Leaching from natural deposits; agricultural runoff
Potassium	ppm	--	--	1.30	ND - 2.1	1.25	ND - 2.1	Erosion of natural deposits
Silica	ppm	--	--	26.7	25 - 28.4	27.1	12 - 47.7	Erosion of natural deposits
Sodium	ppm	--	--	32.0	15 - 84.8	26.0	13.2 - 80.5	Erosion of natural deposits
Vanadium	ppb	--	--	2.79	ND - 13.5	1.70	ND -14	Erosion of natural deposits; discharge from industrial uses

Notes:
1) Lead and copper do not have primary MCLs, but have "action levels" of 15 and 1,300 ppb, respectively. These substances are regulated by the state for public water systems since they can adversely affect public health.
2) One high lead result (1,000 ppb) was not conirmed by follow-up testing. The next highest level measured was 2.35 ppb as shown.
-- Indicates there is no related drinking water standard, or that the substance was not tested.



Do I need to test my water?

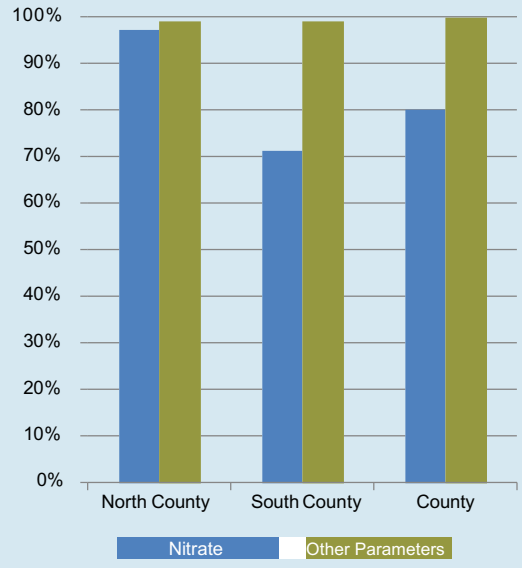
If your water comes from a public water supply, such as a city or water company, it is tested regularly to make sure it meets state and federal drinking water standards.

If your water comes from a private well, the well owner is responsible for making sure it is safe to drink. Although the water district monitors regional groundwater quality, every property and well is unique. Some contaminants are colorless and odorless, so the first step in protecting your health is having your water tested.

The water district encourages private well owners to have their well water tested by a state-certified laboratory annually or anytime there is a change in taste, odor, or appearance. If your water contains any contaminant above drinking water standards, you may want to install a treatment system or use an alternative source of water.

The water district currently offers eligible domestic well users free basic water quality testing and rebates of up to $500 for nitrate treatment systems. Call the Groundwater Hotline at (408) 630-2300 to find out more.

WATER SUPPLY WELLS TESTED IN 2017 MEETING PRIMARY DRINKING WATER STANDARDS



Everyone has a role in protecting groundwater. Well owners should maintain their wells and septic systems, and create a zone of protection around their wells where potential contaminants are not used or stored. See the water district's Guide for the Private Well Owner at www.valleywater.org for helpful tips. All residents can help by conserving water and by raising awareness that activities on the land surface can affect our largest drinking water reservoir, which is beneath our feet.

Hot Topics in Water Quality

Nitrate

As shown in the chart to the left, nitrate is an ongoing challenge, particularly in South County. Common sources are fertilizers, septic systems and livestock waste, so nitrate is often higher in rural and agricultural areas.

Nitrate can interfere with the blood's ability to transport oxygen and is of greatest concern for infants and pregnant women. The effects of consuming high levels of nitrate are often referred to as "blue baby syndrome" and symptoms include shortness of breath and blueness of the skin.

The water district monitors nitrate conditions and trends, helps dilute nitrate through groundwater recharge, and works with land use and regulatory agencies. To help reduce domestic well owners' exposure to elevated nitrate, the water district is offering rebates of up to $500 for eligible treatment systems. Call the Groundwater Hotline at (408) 630-2300 for more information.

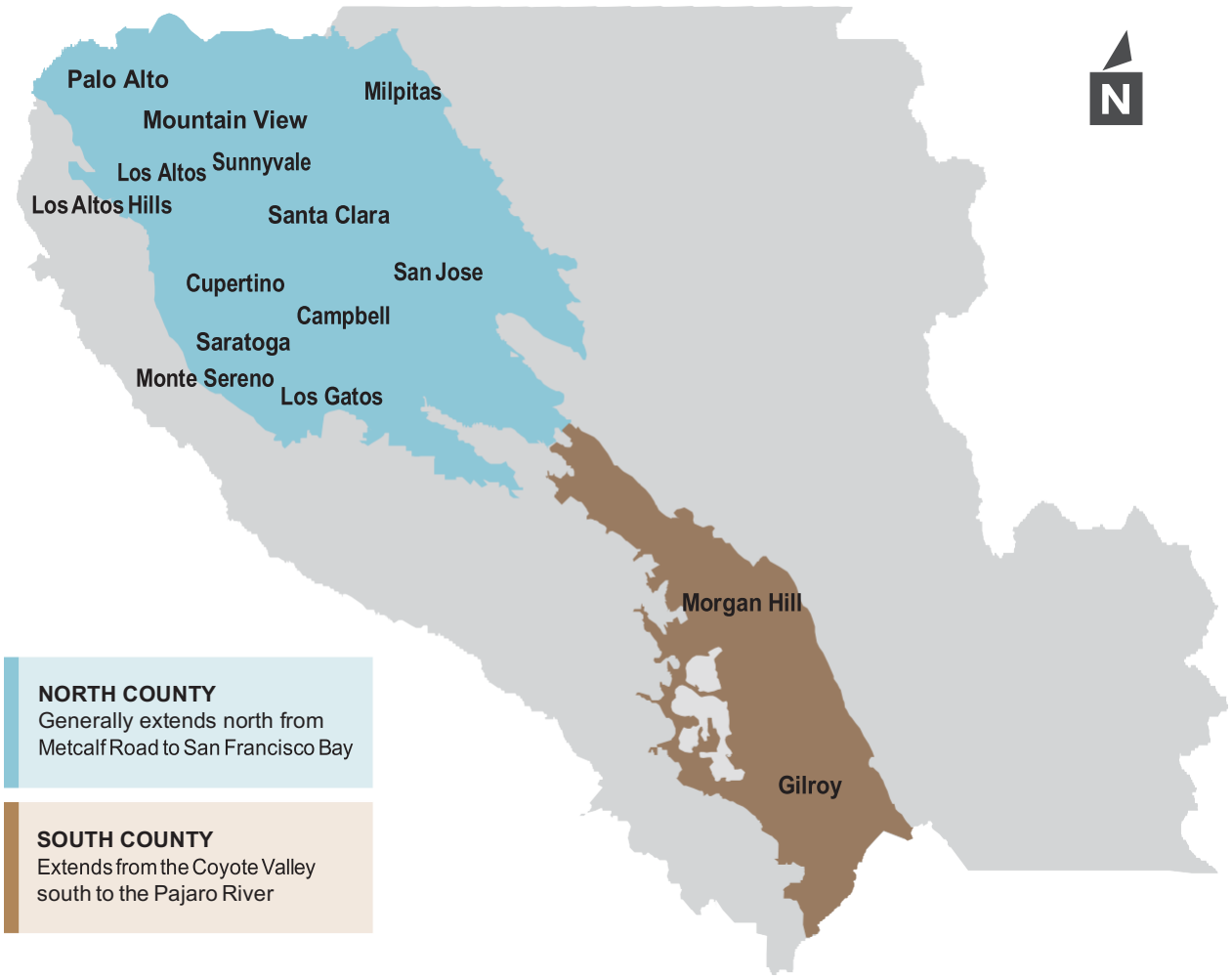
Perchlorate

Perchlorate is a salt used in rocket fuel, highway flares, fireworks and other products. At high levels, perchlorate can interfere with the thyroid gland and affect hormones that regulate metabolism and growth.

Perchlorate contamination from a former highway flare manufacturer in Morgan Hill was first discovered in 2000. At the urging of the water district and the community, the Central Coast Regional Water Quality Board has taken timely action to restore groundwater quality.

Due to cleanup activities and groundwater recharge, perchlorate levels have decreased dramatically. The area affected is getting smaller, now extending from Tennant Avenue south to approximately San Martin Avenue. The responsible party continues to remediate and monitor contaminated groundwater, and provides treatment systems or alternative water supplies for water supply wells with high levels of perchlorate (currently six).

You live on a groundwater basin



Health and education information

All drinking water, including bottled water, may reasonably be expected to contain small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained from the U.S. Environmental Protection Agency's Safe Drinking Water Hotline **(800-426-4791),** the California Division of Drinking Water **(www.waterboards.ca.gov/drinking_water/programs)**, the California Ofice of Environmental Health Hazard Assessment **(*www.oehha.ca.gov/water*)**, or from your healthcare provider.



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Appendix C

2017 Groundwater Quality Results

Table C-1 Summary of 2017 Water Quality Indicator Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	1	13	13	13	43	10.62	12	13	3	11.73	12.0	13	--	--
Total Alkalinity (as CaCO3)	mg/L	21	124	271	517	72	99	220	380	10	162	196	283	--	--
Alkalinity- Bicarbonate (as CaCO3)	mg/L	20	124	271	517	23	77	211	352	7	162	200	283	--	--
Alkalinity- Carbonate (as CaCO3)	mg/L	20	<5	<5	<5	23	<5	<5	41	7	<50	<5	<5	--	--
Alkalinity- Hydroxide (as CaCO3)	Index	20	<5	<5	<5	23	<5	<5	<5	7	<50	<5	<5	--	--
Caffeine	ug/L	1	<0.05	<0.05	<0.05	37	<0.05	<0.05	<0.05	4	<0.05	<0.05	<0.05	--	--
Carbonate Alkalinity	mg/L	21	<2	<5	<5	32	<5	<5	24	9	<2	<5	<50	--	--
Color	Color units	2	<3	2.30	3	27	<3	5	31	3	<3	<3	9	--	15
E. Coli	P/A 100 mL	1	1 Absent	0 Present		--	--	--	--	16	16 Absent	0 Present		--	--
Foaming Agents (MBAS)	ug/L	1	<0.1	<0.1	<0.1	8	<0.1	<0.1	0.1	2	<0.1	<0.1	<0.1	--	500
Total Hardness (as CaCO3)	mg/L	22	107	317	692	72	84	277	472	43	120	267	479	--	--
Hydroxide Alkalinity	mg/L	21	<2	<5	<5	32	<2	<5	<5	9	<2	<5	<50	--	--
Langelier Index @ 60 °C	Index	1	1.2	1.2	1.2	9	-0.43	0.94	1.4	2	1.1	1.2	1.2	--	--
Langelier Index at Source Temp.	Index	--	--	--	--	24	-1.49	-0.05	0.53	--	--	--	--	--	--
Odor Threshold @ 60 °C	TON	1	1	1	1	49	<1	<1	1.4	3	<1	<1	<1	--	3
Dissolved Oxygen	mg/L	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, Field	pH units	20	6.53	7.22	7.56	28	6.79	7.23	8.45	7	6.74	7.4	7.91	--	6.5 - 8.5
pH, Laboratory	pH units	1	8	8	8	48	6.23	7.51	8.1	3	7.45	8.00	8.00	--	6.5 - 8.5
Source Temperature C	C	20	15.8	20.2	21.3	28	18	19.9	24	7	17	19.2	19.9	--	--
Specific Conductance	uS/cm	22	365	786	1,450	79	394	650	1,020	44	380	673	2,380	--	900
Total Coliform[9]	P/A 100 mL	1	1 Absent	0 Present		--	--	--	--	16	11 Absent	5 Present		--	--
Total Organic Carbon (TOC)	mg/L	--	--	--	--	3	<0.3	<0.3	<0.3	--	--	--	--	--	--
Turbidity, Laboratory	NTU	22	<0.1	0.16	340	67	<0.1	0.425	43	10	<0.1	0.160	1.1	--	5

Table C-1 Summary of 2017 Water Quality Indicator Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone				Principal Zone					
		n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Aggressive Index (Corrosivity)	Index	--	--	--	--	4	11.75	11.9	12.05	--	--
Total Alkalinity (as CaCO3)	mg/L	18	101	191	330	22	93	186	344	--	--
Alkalinity- Bicarbonate (as CaCO3)	mg/L	18	101	191	330	18	93	205	344	--	--
Alkalinity- Carbonate (as CaCO3)	mg/L	18	<5	<5	<5	18	<5	<5	<50	--	--
Alkalinity- Hydroxide (as CaCO3)	Index	18	<5	<5	<5	18	<5	<5	<50	--	--
Caffeine	ug/L	--	--	--	--	--	--	--	--	--	--
Carbonate Alkalinity	mg/L	18	<5	<5	<5	18	<5	<5	<50	--	--
Color	Color units	--	--	--	--	2	6	7	8	--	15
E. Coli	P/A 100 mL	8	8 Absent	0 Present		24	24 Absent	0 Present		--	--
Foaming Agents (MBAS)	ug/L	2	<0.1	<0.3	<0.5	--	--	--	--	--	500
Total Hardness (as CaCO3)	mg/L	19	191	316	584	36	140	256	487	--	--
Hydroxide Alkalinity	mg/L	18	<5	<5	<5	18	<5	<5	<50	--	--
Langelier Index @ 60 °C	Index	--	--	--	--	--	--	--	--	--	--
Langelier Index at Source Temp.	Index	--	--	--	--	--	--	--	--	--	--
Odor Threshold @ 60 °C	TON	--	--	--	--	4	<1	<1	<1	--	3
Dissolved Oxygen	mg/L	1	3.34	3.34	3.34	--	--	--	--	--	--
pH, Field	pH units	16	6.33	7.07	7.67	18	7.15	7.70	8	--	6.5 - 8.5
pH, Laboratory	pH units	--	--	--	--	4	7.51	7.68	7.85	--	6.5 - 8.5
Source Temperature C	C	16	15.7	19.7	22.8	16	18.9	19.7	26.6	--	--
Specific Conductance	uS/cm	22	398	672	1,240	92	352	581	1,110	--	900
Total Coliform[9]	P/A 100 mL	8	5 Absent	3 Present		24	14 Absent	10 Present		--	--
Total Organic Carbon (TOC)	mg/L	--	--	--	--	--	--	--	--	--	--
Turbidity, Laboratory	NTU	15	<0.1	0.280	22	22	<0.1	0.225	2.3	--	5

Table C-1 Summary of 2017 Water Quality Indicator Data (Notes)

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW)

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1 ug/L = microgram per liter; mg/L = milligrams per liter; P/A = present/absent per 100 ml; uS/cm = microSiemens per centimeter; NTU = Nephelometric Turbidity Units; TON = Threshold Odor Number

2 The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.

3 The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.

4 n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.

5 The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.

6 For parameters with results reported at multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.

7 MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.

8 SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

9 Total coliform and e. coli bacteria are regulated under the US EPA Total Coliform Rule, which identifies sampling requirements and compliance criteria based on the type of public water system. All wells with data in bacteria results in this table are private, domestic wells that are not subject to federal or state drinking water requirements.

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Appendix C Santa Clara Valley Water District

Table C-2 Summary of 2017 Inorganic Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]									
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions															
Bicarbonate (as HCO3)	mg/L	21	152	331	631	71	94	270	470	10	197	238	345	--	--
Bromide	mg/L	14	0.06	0.15	0.32	26	<0.05	0.120	0.27	40	<0.05	0.125	1.46	--	--
Calcium	mg/L	21	24.8	66.3	158	76	14.6	61.2	110	10	7	53.9	99.6	--	--
Calcium (as CaCO3)	mg/L	20	62	175.5	395	23	36.5	133	274	7	17.5	135	249	--	--
Carbon Dioxide	ug/L	1	<2,000	<2,000	<2,000	30	2.3	13.0	240	2	<2,000	<2,000	<2,000	--	--
Chloride	mg/L	21	12	50	98	71	11	47.5	89	10	15	44.5	100	--	250
Cyanide	ug/L	1	<100	<100	<100	44	<100	<100	<100	5	<100	<100	<100	150	--
Fluoride	mg/L	15	<0.05	0.14	0.37	72	<0.05	0.131	0.29	45	<0.05	0.16	0.28	2	--
Magnesium	mg/L	21	11.4	36.9	77.1	76	7.3	26.3	67	10	22.9	31.7	61.1	--	--
Perchlorate	ug/L	14	<4	<4	<4	72	<4	<4	<4	11	<4	<4	<4	6	--
Potassium	mg/L	21	0.7	1.4	2.5	69	<1	1.30	3.9	10	1	1.40	1.9	--	--
Silica	mg/L	20	17.9	24.4	34.5	26	2.5	26.2	43.4	7	20.6	22.7	37.8	--	--
Sodium	mg/L	21	22.2	38.9	178	75	15	30.5	98.7	10	22	25.8	106	--	--
Sodium Adsorption Ratio	ratio	21	0.63	1.41	4.8	70	0.53	0.910	5.6	10	0.67	0.820	3.4	--	--
Sulfate	mg/L	15	35.2	49.4	164	71	1.9	46.6	100	43	<0.5	44.2	117	--	250
Total Dissolved Solids	mg/L	21	182	438	928	72	222	390	1,100	16	266	372	604	--	500
Nutrients														--	--
Ammonia	mg/L	--	--	--	--	3	<0.05	<0.05	<0.05	--	--	--	--	--	--
Nitrate + Nitrite (as N)	ug/L	1	1.5	1.5	1.5	48	<0.4	2.55	6.1	8	0.41	1.60	7.1	10,000	--
Nitrate (as N)	mg/L	15	<0.05	1.5	6.1	234	<0.05	3.06	9.7	66	<0.05	7.20	49.1	10	--
Nitrite (as N)	ug/L	1	<400	<400	<400	51	<400	<400	<50	9	<400	<400	<400	1,000	--
Orthophosphate	mg/L	14	<0.05	0.110	0.44	26	<0.05	0.120	1.82	40	<0.05	0.050	1.56	--	--
Trace Elements														--	--
Aluminum	ug/L	21	<20	30.2	3,800	77	<20	17.6	1,700	13	<20	18.8	820	1,000	200
Antimony	ug/L	21	<1	<1	<6	74	<1	<6	<6	12	<1	<1	<6	6	--
Arsenic	ug/L	21	<2	<2	11	74	<2	<2	5	12	<2	<2	3	10	--
Asbestos	MFL	1	<0.2	<0.2	<0.2	10	<0.2	<0.2	0.7	1	<0.2	<0.2	<0.2	7	--
Barium	ug/L	21	<100	<100	320	73	<100	131	310	12	<100	105	270	1,000	--
Beryllium	ug/L	21	<1	<1	<1	73	<1	<1	<1	12	<1	<1	<1	4	--
Boron	ug/L	20	92	181	830	30	<100	133	506	7	52	139	153	--	--
Cadmium	ug/L	21	<1	<1	<1	74	<1	<1	<1	12	<1	<1	<1	5	--
Total Chromium	ug/L	21	<1	<1	10	75	<1	<1	9.2	12	<1	1.80	3.4	50	--
Hexavalent Chromium	ug/L	1	2.5	2.50	2.5	53	<1	2.10	7.9	2	4.5	4.65	4.8	--	--
Cobalt	ug/L	20	<1	<1	2.4	29	<1	<1	<1	7	<1	<1	<1	--	--
Copper	ug/L	21	<1	1.3	8.9	78	<1	<1	120	10	<1	<1	6.3	--	1,000
Iron	ug/L	21	<20	<20	3600	97	<20	32.0	3,900	11	<10	<20	54.1	--	300
Lead	ug/L	21	<1	<1	1.93	73	<1	<1	16	12	<1	<1	<5	--	--
Lithium	ug/L	20	<5	6.40	22	26	<5	7.05	33	7	9.4	13.0	27	--	--
Manganese	ug/L	21	<20	17.3	948	82	<1	2.1	240	11	<1	0.371	114	--	50
Mercury	ug/L	21	<1	<1	1.9	71	<1	<1	<1	12	<1	<1	<1	2	--
Molybdenum	ug/L	20	<1	1.9	27	29	<1	<1	11	7	<1	<1	12	--	--
Nickel	ug/L	21	<1	1	11.9	74	<10	<10	16	12	<1	<1	1.40	100	--
Selenium	ug/L	21	<5	<5	<5	74	<5	<5	11	12	<5	<5	<5	50	--
Silver	ug/L	21	<1	<1	<10	71	<1	<10	<10	10	<1	<1	<10	--	100
Thallium	ug/L	21	<1	<1	<1	74	<1	<1	<1	12	<1	<1	<1	2	--
Vanadium	ug/L	20	<1	2.15	13	29	<1	2.1	13.5	7	<1	1.50	11	--	--

Zinc	ug/L	21	<10	<10	<50	76	<10	<10	1,200	10	<10	<10	340	--	5,000

Table C-2 Summary of 2017 Inorganic Data

Parameter	Units[1]	Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone				Principal Zone					
		n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Major and Minor Ions											
Bicarbonate (as HCO3)	mg/L	18	123	233	402	22	114	227	419	--	--
Bromide	mg/L	22	<0.05	0.145	0.37	32	<0.05	0.160	0.36	--	--
Calcium	mg/L	18	35.7	59.3	99.6	22	32.9	51.1	98.2	--	--
Calcium (as CaCO3)	mg/L	18	89.3	148	249	18	82.2	139	246	--	--
Carbon Dioxide	ug/L	--	--	--	--	--	--	--	--	--	--
Chloride	mg/L	18	11	44.5	80	23	19	52	135	--	250
Cyanide	ug/L	2	<0.03	<0.263	<0.5	6	<100	<100	<100	150	--
Fluoride	mg/L	22	<0.05	0.123	0.24	38	<0.05	0.120	0.28	2	--
Magnesium	mg/L	18	18.5	51.2	73.9	22	17	28.2	59.2	--	--
Perchlorate	ug/L	18	<4	<4	4.62	84	<4	<4	4.5	6	--
Potassium	mg/L	18	<0.5	1.10	2	22	<0.5	1.30	2.1	--	--
Silica	mg/L	18	18.7	30.2	41.7	18	12.9	28.7	47.7	--	--
Sodium	mg/L	18	11.8	24.6	79.9	23	13.2	28.1	80.5	--	--
Sodium Adsorption Ratio	ratio	16	0.39	0.710	2.1	23	0.42	0.830	2.8	--	--
Sulfate	mg/L	22	13.3	40.2	142	37	12.6	37.7	73.9	--	250
Total Dissolved Solids	mg/L	18	208	388	772	23	266	370	608	--	500
Nutrients											
Ammonia	mg/L	--	--	--	--	--	--	--	--	--	--
Nitrate + Nitrite (as N)	ug/L	--	--	--	--	6	2.2	3.40	6.6	10,000	--
Nitrate (as N)	mg/L	22	<0.05	10.0	56.5	185	<0.05	5.20	24	10	--
Nitrite (as N)	ug/L	--	--	--	--	12	<400	<400	<400	1,000	--
Phosphate, Ortho	mg/L	22	<0.05	0.105	0.37	32	<0.05	0.090	0.85	--	--
Trace Elements											
Aluminum	ug/L	18	<20	22.3	360	24	<20	14.8	71	1,000	200
Antimony	ug/L	18	<1	<1	<1	27	<1	<1	9.9	6	--
Arsenic	ug/L	18	<2	<2	3	24	<2	<2	4	10	--
Asbestos	MFL	--	--	--	--	5	<0.2	0.790	18	7	--
Barium	ug/L	18	11	145	430	24	<100	115	300	1,000	--
Beryllium	ug/L	18	<1	<1	<1	24	<1	<1	<1	4	--
Boron	ug/L	18	<50	121	219	22	<50	111	2,000	--	--
Cadmium	ug/L	18	<1	<1	<1	24	<1	<1	<1	5	--
Total Chromium	ug/L	18	<1	1.05	7.2	24	<1	1.30	3.8	50	--
Hexavalent Chromium	ug/L	--	--	--	--	8	<1	2.80	7.8	--	--
Cobalt	ug/L	18	<1	<1	<1	18	<1	<1	<1	--	--
Copper	ug/L	18	<1	1.75	9.8	22	<1	3.10	16.6	--	1,000
Iron	ug/L	18	<20	<20	620	24	<20	11.9	200	--	300
Lead	ug/L	18	<1	<1	2.35	27	<1	<1	1,000[9]	--	--
Lithium	ug/L	18	<5	9.50	35	18	<5	11.0	28	--	--
Manganese	ug/L	18	<1	1.27	43.7	23	<1	1.30	130	--	50
Mercury	ug/L	18	<1	<1	<1	24	<1	<1	<1	2	--
Molybdenum	ug/L	18	<1	<1	<1	18	<1	<1	3.5	--	--
Nickel	ug/L	18	<1	0.800	11.2	24	<1	<1	4.5	100	--
Selenium	ug/L	18	<5	<5	5	24	<5	<5	<5	50	--
Silver	ug/L	18	<1	<1	3.2	22	<1	<1	<10	--	100
Thallium	ug/L	18	<1	<1	<1	24	<1	<1	<1	2	--

Vanadium	ug/L	18	<1	1.65	16	18	<1	2.60	14	--	--
Zinc	ug/L	18	<10	<10	130	22	<10	4.40	91	--	5,000

Table C-2 Summary of 2017 Inorganic Data (Notes)

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1 mg/L = milligrams per liter; ug/L = micrograms per liter; MFL = million fibers per liter.

2 The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.

3 The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.

4 n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.

5 The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.

6 For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.

7 MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.

8 SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA. For SMCLs having a range, the lower, recommended threshold is listed first with the upper threshold in parentheses.

9 Verification sampling conducted did not confirm the high lead result. All subsequent results were below detection level (5 ppb).

Table C-3 Summary of 2017 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
1,1,1,2-Tetrachlorethane	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,1,1-Trichloroethane	ug/L	3	D	0.5	91	D	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	200	--
1,1,2,2-Tetrachloroethane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	1	--
1,1,2-Trichloro-1-2-2-Trifluoroethane (Freon 113)	ug/L	3	ND	10	90	ND	10	4	ND	10	3	ND	2	38	ND	10	1,200	--
1,1,2-Trichloroethane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--
1,1-Dichloroethane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--
1,1-Dichloroethene	ug/L	3	ND	0.5	90	D	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	6	--
1,1-Dichloropropene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,2,3-Trichlorobenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,2,3-Trichloropropane	ug/L	2	ND	0.5	45	ND	0.5	--	--	--	3	ND	0.5	4	ND	0.005	0.005	--
1,2,4-Trichlorobenzene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--
1,2,4-Trimethylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,2-Dichlorobenzene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	600	--
1,2-Dichloroethane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	0.5	--
1,2-Dichloropropane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--
1,3,5-Trimethylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,3-Dichlorobenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
1,3-Dichloropropane	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	0.5	--
1,3-Dichloropropene (Total)	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--

Table C-3 Summary of 2017 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
4-Chlorotoluene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Benzene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	1	--
Benzo (a) Pyrene	ug/L	1	ND	0.1	98	ND	0.1	9	ND	0.1	--	--	--	8	ND	0.1	0.2	--
Bromobenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Bromochloromethane	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Bromodichloromethane (THM)	ug/L	3	ND	1	29	D	1	2	ND	1	3	ND	0.5	32	ND	1	--	--
Bromoform (THM)	ug/L	3	ND	1	29	D	1	2	ND	1	3	ND	0.5	32	ND	1	--	--
Bromomethane	ug/L	3	ND	0.5	16	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Carbon Disulfide	ug/L	1	ND	0.5	8	ND	0.5	2	ND	0.5	--	--	--	--	--	--	--	--
Carbon Tetrachloride	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	--	0.5	38	--	0.5	0.5	--
Chloroethane	ug/L	3	ND	0.5	16	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Chloroform (THM)	ug/L	3	ND	1	29	D	1	2	ND	1	3	ND	0.5	32	ND	1	--	--
Chloromethane	ug/L	3	ND	0.5	16	ND	0.5	2	ND	0.5	3	ND	0.5	32	D	0.5	--	--
cis-1-2-Dichloroethene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	6	--
Di(2-Ethylhexyl)Adipate	ug/L	1	ND	5	100	ND	5	9	ND	5	--	ND	--	8	ND	5	400	--
Di(2-Ethylhexyl)Phthalate	ug/L	1	ND	3	100	ND	3	9	ND	3	--	--	--	8	ND	3	4	--
Dibromoacetic Acid (DBAA)	ug/L	--	ND	--	1	ND	1	--	ND	--	2	--	1	--	--	--	--	--
Dibromochloromethane (THM)	ug/L	3	--	1	29	D	1	2	--	1	3	ND	0.5	32	--	1	--	--
Dibromochloropropane (DBCP)	ug/L	1	ND	0.01	76	ND	0.01	8	ND	0.01	--	ND	--	8	ND	0.01	0.2	--
Dibromomethane	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	--	0.5	32	ND	0.5	--	--
	ug/L	--	ND	--	1	D	2.7	--	ND	--	2	ND	1	--	ND	--	--	--

Table C-3 Summary of 2017 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Ethylenediaminetetraacetic Acid	ug/L	--	--	--	--	--	--	--	--	--	2	ND	0.5	--	--	--	--	--
Ethyl-Tert-Butyl Ether	ug/L	3	ND	3	28	ND	3	2	ND	3	3	ND	2	32	ND	3	--	--
Haloacetic Acids (5) (HAA5)	ug/L	--	--	--	1	D	4.4	--	--	--	2	ND	1	--	--	--	60	--
Hexachlorobutadiene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Isopropylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Methyl Ethyl Ketone (MEK-Butanone)	ug/L	1	ND	5	21	ND	5	2	ND	5	--	--	--	32	ND	5	--	--
Methyl Isobutyl Ketone	ug/L	1	ND	5	21	ND	5	2	ND	5	--	--	--	32	ND	5	--	--
Methyl-Tert-Butyl-Ether (MTBE)	ug/L	3	ND	3	90	ND	3	4	ND	3	3	ND	2	38	ND	3	13	5
Monobromoacetic Acid (MBAA)	ug/L	--	--	--	1	D	1.7	--	--	--	2	ND	1	--	--	--	--	--
Monochloroacetic Acid (MCAA)	ug/L	--	--	--	1	ND	2	--	--	--	2	ND	2	--	--	--	--	--
Monochlorobenzene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	70	--
m,p-Xylene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Naphthalene	ug/L	3	ND	0.5	29	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
N-Butylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Nitrilotriacetic Acid (NTA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	0.5	--	--	--	--	--
N-Nitrosodiethylamine (NDEA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	2	--	--	--	--	--
N-Nitrosodimethylamine (NDMA)	ug/L	--	--	--	--	--	--	--	--	--	4	ND	2	--	--	--	--	--
N-Nitrosodi-N-Butylamine (NDBA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	2	--	--	--	--	--
N-Nitrosodi-N-Propylamine (NDPA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	2	--	--	--	--	--
N-Nitrosomethylethylamine (NMEA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	2	--	--	--	--	--

Table C-3 Summary of 2017 Volatile Organic Compound (VOC) Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
PCB-1248	ug/L	1	ND	0.5	71	ND	0.5	8	ND	0.5	--	--	--	8	ND	0.5	0.5	--
PCB-1254	ug/L	1	ND	0.5	71	ND	0.5	8	ND	0.5	--	--	--	8	ND	0.5	0.5	--
PCB-1260	ug/L	1	ND	0.5	71	ND	0.5	8	ND	0.5	--	--	--	8	ND	0.5	0.5	--
Perfluoro Butanoic Acid (PFBA)	ug/L	--	--	--	--	--	--	--	--	--	2	ND	10	--	--	--	--	--
Perfluoro Octanesulfonate (PFOS)	ug/L	--	--	--	--	--	--	--	--	--	2	D	0.5	--	--	--	--	--
Perfluoro Octanoic Acid (PFOA)	ug/L	--	--	--	--	--	--	--	--	--	2	D	9	--	--	--	--	--
p-Isopropyltoluene	ug/L	3	ND	0.5	15	ND	0.5	2	ND	0.5	3	ND	0.5	--	--	--	--	--
Polychlorinated Biphenyls (Total PCBS)	ug/L	1	ND	0.5	74	ND	0.5	8	ND	0.5	--	--	--	8	ND	0.5	0.5	--
sec-Butylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Styrene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	100	--
Tert-Amyl-Methyl Ether	ug/L	3	ND	3	28	ND	3	2	ND	3	3	ND	2	32	ND	3	--	--
Tert-Butyl Alcohol	ug/L	2	ND	2	6	ND	2	--	--	--	3	ND	2	32	ND	2	--	--
Tert-Butylbenzene	ug/L	3	ND	0.5	28	ND	0.5	2	ND	0.5	3	ND	0.5	32	ND	0.5	--	--
Tetrachloroethene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	ND	0.5	5	--
Toluene	ug/L	3	ND	0.5	90	ND	0.5	4	ND	0.5	3	ND	0.5	38	D	0.5	150	--
Total Trihalomethanes	ug/L	1	ND	0.5	9	ND	0.5	2	ND	0.5	--	--	--	1	ND	1.6	80	--
Trans-1,2-Dichloroethene	ug/L	3	ND	0.5	90	D	0.5	4	ND	0.5	3	ND	0.5	38	D	0.5	10	--
Trichloroacetic Acid (TCAA)	ug/L	--	ND	--	1	ND	1	--	ND	--	2	ND	1	--	--	--	--	--

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented. Unless construction is known, DDW wells are assumed to represent the principal zone, as these are typically deep wells.

1. ug/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples. D = detection above reporting limit in one or more samples (see Table C-4 for more information).
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-4 Summary of 2017 Volatile Organic Compounds (VOCs) Detections

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
1,1,1-Trichloroethane	ug/L	3	<0.5	<0.5	0.8	91	<0.5	<0.5	4.3	4	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	38	<0.5	<0.5	<0.5	200	--
1,1-Dichloroethene	ug/L	3	<0.5	<0.5	<0.5	90	<0.5	<0.5	6.8	4	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	38	<0.5	<0.5	<0.5	6	--
Bromodichloromethane	ug/L	3	<0.5	<0.5	<1	29	<0.5	<1	5.15	2	<1	<1	<1	3	<0.5	<0.5	<0.5	32	<1	<1	<1	--	--
Bromoform	ug/L	3	<0.5	<0.5	<1	29	<0.5	<1	5.43	2	<1	<1	<1	3	<0.5	<0.5	<0.5	32	<1	<1	<1	--	--
Chloroform	ug/L	3	<0.5	<0.5	<1	29	<0.5	<1	2.74	2	<1	<1	<1	3	<0.5	<0.5	<0.5	32	<1	<1	1.6	--	--
Dibromochloromethane	ug/L	3	<0.5	<0.5	<1	29	<0.5	<1	7.92	2	<1	<1	<1	3	<0.5	<0.5	<0.5	32	<1	<1	<1	--	--
Dichloroacetic Acid	ug/L	--	--	--	--	1	2.7	2.7	2.7	--	--	--	--	2	<1	<1	<1	--	--	--	--	--	--
HAA5 - Haloacetic Acids (5) (HAA5)	ug/L	--	--	--	--	1	4.4	4.4	4.4	--	--	--	--	2	<0.5	<0.5	<0.5	--	--	--	--	60	--
Monobromoacetic Acid (MBAA)	ug/L	--	--	--	--	1	1.7	1.7	1.7	--	--	--	--	2	<1	<1	<1	--	--	--	--	--	--
Perfluoro Octanesulfonate (PFOS)	ng/L	--	--	--	--	--	--	--	--	--	--	--	--	2	<0.5	3	5.7	--	--	--	--	--	--
Perfluoro Octanoic Acid (PFOA)	ng/L	--	--	--	--	--	--	--	--	--	--	--	--	2	9	12.5	16	--	--	--	--	--	--
Tetrachloroethene	ug/L	3	<0.5	<0.5	<0.5	90	<0.5	<0.5	<0.5	4	<0.5	<0.5	<0.5	3	<0.5	<0.5	<0.5	38	<0.5	<0.5	2.2	5	--
Total Trihalomethanes	ug/L	1	<0.5	<0.5	<0.5	9	<0.5	<0.5	21.2	2	<0.5	<0.5	<0.5	--	--	--	--	1	1.6	1.6	1.6	80	--

Notes:

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. ug/L = micrograms per liter; ng/L = nanograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-5 Summary of 2017 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
2-3-7-8-TCDD (Dioxin)	ug/L	1	ND	0.000005	73	ND	5	8	ND	5	--	--	--	5	ND	0.000005	0.00003	--
2-4-5-T	ug/L	--	--	--	12	ND	1	--	--	--	--	--	--	--	--	--	--	--
2-4-5-TP (Silvex)	ug/L	1	ND	1	99	ND	1	9	ND	1	--	--	--	10	ND	1	50	--
2-4-D	ug/L	1	ND	10	99	ND	10	9	ND	10	--	--	--	13	ND	10	70	--
3-Hydroxycarbofuran	ug/L	1	ND	3	62	ND	3	8	ND	3	--	--	--	7	ND	3	--	--
4-4-DDD	ug/L	--	--	--	1	ND	0.02	--	--	--	--	--	--	2	ND	0.02	--	--
4-4-DDE	ug/L	--	--	--	1	ND	0.01	--	--	--	--	--	--	2	ND	0.01	--	--
4-4-DDT	ug/L	--	--	--	1	ND	0.02	--	--	--	--	--	--	2	ND	0.02	--	--
Acetochlor	ug/L	--	--	--	1	ND	0.1	--	--	--	--	--	--	--	--	--	--	--
Alachlor	ug/L	2	ND	1	76	ND	1	9	ND	1	--	--	--	12	ND	1	2	--
Aldicarb	ug/L	1	ND	3	62	ND	3	8	ND	3	--	--	--	7	ND	3	--	--
Aldicarb Sulfone	ug/L	1	ND	4	62	ND	4	8	ND	4	--	--	--	7	ND	2	--	--
Aldicarb Sulfoxide	ug/L	1	ND	3	62	ND	3	8	ND	3	--	--	--	7	ND	3	--	--
Aldrin	ug/L	2	ND	0.075	45	ND	0.075	4	ND	0.075	--	--	--	2	ND	0.075	--	--
Alpha-BHC	ug/L	--	--	--	1	ND	0.01	--	--	--	--	--	--	2	ND	0.01	--	--
Atrazine	ug/L	1	ND	0.5	86	ND	0.5	9	ND	0.5	--	--	--	12	ND	0.5	1	--
Bentazon	ug/L	1	ND	2	99	ND	2	9	ND	2	--	--	--	10	ND	2	18	--
Beta-Bhc	ug/L	--	--	--	1	ND	0.05	--	--	--	--	--	--	2	ND	0.05	--	--
Bromacil	ug/L	1	ND	10	38	ND	10	6	ND	10	--	--	--	2	ND	5	--	--
Butachlor	ug/L	1	ND	0.38	37	ND	0.38	5	ND	0.38	--	--	--	--	--	--	--	--
Carbaryl	ug/L	1	ND	5	62	ND	5	8	ND	5	--	--	--	7	ND	5	--	--
Carbofuran	ug/L	1	ND	5	71	ND	5	8	ND	5	--	--	--	9	ND	5	18	--
Chlordane	ug/L	1	ND	0.1	74	ND	0.1	8	ND	0.1	--	--	--	8	ND	0.1	0.1	--

Table C-s Summary of 2017 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Chlorothalonil	ug/L	--	--	--	1	ND	5	--	--	--	--	--	--	2	ND	5	--	--
cis-1,3-Dichloropropene	ug/L	3	ND	0.5	16	ND	0.5	2	ND	0.5	3	ND	0.5	25	ND	0.5	0.5	--
Dalapon	ug/L	1	ND	10	99	ND	10	9	ND	10	--	--	--	10	ND	10	200	--
DCPA	ug/L	1	ND	0.1	37	D	0.1	4	ND	0.1	--	--	--	--	--	--	--	--
Delta-BHC	ug/L	--	--	--	1	ND	0.05	--	--	--	--	--	--	2	ND	0.05	--	--
Diazinon	ug/L	1	ND	0.1	31	ND	2	5	ND	2	--	--	--	2	ND	2	--	--
Dicamba	ug/L	1	ND	1.5	49	ND	1.5	5	ND	1.5	--	--	--	1	ND	1.5	--	--
Dieldrin	ug/L	1	ND	0.02	41	ND	0.02	4	ND	0.02	--	--	--	2	ND	0.02	--	--
Dimethoate	ug/L	1	ND	0.1	38	ND	2	5	ND	2	--	--	--	2	ND	2	--	--
Dinoseb	ug/L	1	ND	2	99	ND	2	9	ND	2	--	--	--	10	ND	2	7	--
Diquat	ug/L	1	ND	4	72	ND	4	8	ND	4	--	--	--	9	ND	4	20	--
Endosulfan I	ug/L	--	--	--	1	ND	0.01	--	--	--	--	--	--	2	ND	0.01	--	--
Endosulfan II	ug/L	--	--	--	1	ND	0.01	--	--	--	--	--	--	2	ND	0.01	--	--
Endosulfan Sulfate	ug/L	--	--	--	1	ND	0.05	--	--	--	--	--	--	2	ND	0.05	--	--
Endothall	ug/L	1	ND	45	72	ND	45	8	ND	45	--	--	--	8	ND	45	100	--
Endrin	ug/L	1	ND	0.1	74	ND	0.1	8	ND	0.1	--	--	--	8	ND	0.1	2	--
Endrin Aldehyde	ug/L	--	--	--	1	ND	0.05	--	--	--	--	--	--	2	ND	0.05	--	--
EPTC	ug/L	--	--	--	2	ND	0.1	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC (Lindane), Total	ug/L	2	ND	0.2	76	ND	0.2	8	ND	0.2	--	--	--	8	ND	0.2	0.2	--
Glyphosate	ug/L	1	ND	25	72	ND	25	7	ND	25	--	--	--	8	ND	25	700	--
Heptachlor	ug/L	1	ND	0.01	73	ND	0.01	8	ND	0.01	--	--	--	8	ND	0.01	0.01	--
Heptachlor Epoxide	ug/L	1	ND	0.01	74	ND	0.01	8	ND	0.01	--	--	--	8	ND	0.01	0.01	--
Hexachlorobenzene	ug/L	1	ND	0.5	86	ND	0.5	8	ND	0.5	--	--	--	8	ND	0.5	1	--
Hexachlorocyclopentadiene	ug/L	1	ND	1	86	ND	1	8	ND	1	--	--	--	8	ND	1	50	--
Methiocarb	ug/L	1	ND	0.5	37	ND	0.5	4	ND	0.5	--	--	--	--	--	--	--	--
Methomyl	ug/L	1	ND	2	62	ND	2	8	ND	2	--	--	--	7	ND	2	--	--
Methoxychlor	ug/L	2	ND	10	76	ND	10	8	ND	10	--	--	--	8	ND	10	30	--
Metolachlor	ug/L	1	ND	0.05	38	ND	1	5	ND	1	--	--	--	2	ND	1	--	--
Metribuzin	ug/L	1	ND	0.05	38	ND	0.1	5	ND	0.1	--	--	--	2	ND	0.1	--	--
Molinate	ug/L	1	ND	2	86	ND	2	9	ND	2	--	--	--	9	ND	2	20	--
Oxamyl	ug/L	1	ND	20	71	ND	20	8	ND	20	--	--	--	9	ND	20	50	--

Table C-5 Summary of 2017 Pesticide Data (Detect/Non-Detect)

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain						Santa Clara Subbasin, Coyote Valley			Llagas Subbasin						Maximum Contaminant Level	
		Shallow Zone[2]			Principal Zone[3]						Shallow Zone			Principal Zone				
		n[4]	Result[5]	RL[6]	n	Result	RL	n	Result	RL	n	Result	RL	n	Result	RL	MCL[7]	SMCL[8]
Pentachlorophenol	ug/L	1	ND	0.2	99	ND	0.2	9	ND	0.2	--	--	--	10	ND	0.2	1	--
Picloram	ug/L	1	ND	1	99	ND	1	9	ND	1	--	--	--	10	ND	1	500	--
Prometryn	ug/L	--	--	--	1	ND	2	1	ND	2	--	--	--	2	ND	2	--	--
Propachlor	ug/L	1	ND	0.5	38	ND	0.5	5	ND	0.5	--	--	--	2	ND	0.5	--	--
Propoxur	ug/L	1	ND	0.5	37	ND	0.5	4	ND	0.5	--	--	--	--	--	--	--	--
Simazine	ug/L	1	ND	1	86	ND	1	9	ND	1	--	--	--	12	ND	1	4	--
Terbacil	ug/L	--	--	--	31	ND	0.1	--	--	--	--	--	--	--	--	--	--	--
Terbuthylazine	ug/L	--	--	--	--	--	--	--	--	--	3	ND	0.1	--	--	--	--	--
Thiobencarb	ug/L	1	ND	1	86	ND	1	9	ND	1	--	--	--	9	ND	1	70	1
Toxaphene	ug/L	1	ND	1	74	ND	1	8	ND	1	--	--	--	8	ND	1	3	--
trans-1,3-Dichloropropene	ug/L	3	ND	0.5	16	ND	0.5	2	ND	0.5	3	ND	0.5	25	ND	0.5	--	--

Notes:
Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW). Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are deep wells.

1. ug/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. ND= not detected above laboratory reporting limit in any samples.
6. RL = Laboratory reporting limit. In the case of multiple reporting limits, the highest limit is shown. NA is shown if the reporting limit is not available.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA

Table C-6 Summary of 2017 Pesticide Detections

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Level	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
DCPA	ug/L	1	<0.1	<0.1	<0.1	37	<0.1	<0.1	0.7	4	<0.1	<0.1	<0.1	--	--	--	--	--	--	--	--	--	--

Notes:

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically deep wells.

1. ug/L = micrograms per liter.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <0.1) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Table C-7 Summary of 2017 Radioactive Data

Parameter	Units[1]	Santa Clara Subbasin, Santa Clara Plain								Santa Clara Subbasin, Coyote Valley				Llagas Subbasin								Maximum Contaminant Levels	
		Shallow Zone[2]				Principal Zone[3]								Shallow Zone				Principal Zone					
		n[4]	Min[5]	Median[6]	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	n	Min	Median	Max	MCL[7]	SMCL[8]
Gross Alpha	pCi/L	1	<3	<3	<3	26	<3	2.03	8.3	1	0.435	0.435	0.435	--	--	--	--	1	<3	<3	<3	15	--
Gross Beta (Dose Equivalent)	mrem/yr	--	--	--	--	--	--	--	--	1	0.148	0.148	0.148	--	--	--	--	--	--	--	--	4	--
Radium 226	pCi/L	--	--	--	--	3	<1	<1	<1	1	0.128	0.128	0.128	--	--	--	--	--	--	--	--	--	--
Radium 228	pCi/L	--	--	--	--	3	<1	<1	<1	1	<1	<1	<1	--	--	--	--	--	--	--	--	--	--
Strontium-90	pCi/L	--	--	--	--	--	--	--	--	1	<2	<2	<2	--	--	--	--	--	--	--	--	8	--
Tritium	pCi/L	--	--	--	--	--	--	--	--	1	170	170	170	--	--	--	--	--	--	--	--	20,000	--
Uranium	pCi/L	--	--	--	--	5	<1	<1	<1	1	0.294	0.294	0.294	--	--	--	--	--	--	--	--	20	--

Notes:

Table includes data for wells monitored by the District (monitoring wells and water supply wells) and public water system data reported to the CA Division of Drinking Water (DDW).

Only wells with known construction information are presented in this table. DDW wells are assumed to represent the principal zone if no construction information is available, as these are typically dee

1. pCi/L = picocuries per liter; mrem/yr = millirem per year.
2. The shallow aquifer zone is represented by wells primarily drawing water from depths less than 150 feet.
3. The principal aquifer zone is represented by wells primarily drawing water from depths greater than 150 feet.
4. n = number of results for each parameter. Some parameters may have been analyzed more than once at a particular well.
5. The minimum shown is the lowest detected value. The lowest reporting limit (e.g., <5) is shown when there are no quantified values at the lowest reporting limit.
6. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
7. MCL = Maximum Contaminant Level specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
8. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard, per DDW or US EPA.

Appendix D

2017 Recycled Water Irrigation Site Monitoring Results

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Table D-1 Summary of 2017 Data from Recycled Water Irrigation Sites							
Parameter	**Units**	**Santa Clara Subbasin, Santa Clara Plain**				**Maximum Contaminant Level**	
		n	**Min**	**Median**	**Max**	**MCL**	**SMCL**
Major and Minor Ions							
Calcium	mg/L	17	61	77.5	380	-	-
Calcium (as $CaCO_3$)	mg/L	17	83.1	83.1	83.1	-	-
Chloride	mg/L	17	51	125	150	-	250
Magnesium	mg/L	17	33	67.0	120	-	-
Potassium	mg/L	17	<0.040	1.50	3.2	-	-
Sodium	mg/L	17	33	62.0	150	-	-
Sulfate	mg/L	17	39	88.0	940	-	250
Total Dissolved Solids	mg/L	17	510	750	2,200	-	500
Nutrients							
Nitrate (as NO3)	mg/L	17	13	15.5	42	45	-
Trace Elements							
Boron	ug/L	17	0.082	0.205	0.56	-	-
Organics							
N-nitrosodiethylamine (NDEA)	ng/L	4	1.8	1.8	1.8	-	-
Perfluooctanoic Acid (PFOA)	ng/L	4	<5	<5	7.6	-	-

Notes:

1. Table includes data for wells near areas irrigated with water from South Bay Water Recycling (SBWR).
2. n = the number of results for each parameter.
3. mg/L = milligrams per liter; ug/L = micrograms per liter; ng/L = nanograms per liter
4. The minimum shown is the lowest detected value. The lowest reporting limit is shown (e.g., <5) when there are no quantified values at that reporting limit.
5. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
6. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard per DDW or US EPA.
7. If a measured parameter was not detected in any sampling events in 2017, it is not listed in the table above.

Table D-2 Summary of 2017 Data from Recycled Water Irrigation Sites

Parameter	Units	Llagas Subbasin				Maximum Contaminant Level	
		n	Min	Median	Max	MCL	SMCL
Major and Minor Ions							
Bicarbonate	mg/L	58	52	192	525	-	-
Bromide	mg/L	58	<0.05	0.070	3.08	-	-
Calcium	mg/L	58	15.7	50.0	147	-	-
Calcium (as $CaCO_3$)	mg/L	58	39.2	125	368	-	-
Chloride	mg/L	58	7	32.0	201	-	250
Cyanide	mg/L	58	0.005	0.025	0.025	0.15	-
Fluoride	mg/L	58	<0.05	0.110	0.49	2	-
Magnesium	mg/L	58	6.1	25.3	87.2	-	-
Perchlorate	ug/L	58	<4	<4	<4	6	-
Potassium	mg/L	58	<0.5	1.00	3.2	-	-
Silica	mg/L	58	14.7	24.9	34.8	-	-
Sodium	mg/L	58	<0.5	24.4	149	-	-
Sulfate	mg/L	58	3.3	43.2	138	-	250
Total Dissolved Solids	mg/L	58	78	305	868	-	500
Nutrients							
Nitrate (as N)	mg/L	58	<0.05	2.75	39.6	10	-
Phosphate, Ortho	mg/L	58	<0.05	0.06	0.63	-	-
Trace Elements							
Aluminium[5]	ug/L	58	<20	34.8	170	1,000	200
Antimony	ug/L	58	<1	<1	<1	6	-
Arsenic	ug/L	58	<2	<2	2	10	-
Barium	ug/L	58	40	91.5	500	1,000	-
Beryllium	ug/L	58	<1	<1	<1	4	-
Boron	ug/L	58	<50	103	384	-	-
Cadmium	ug/L	58	<1	<1	<1	5	-
Chromium (Total)	ug/L	58	<1	0.750	3.3	50	-
Cobalt	ug/L	58	<1	<1	4.7	-	-
Copper	ug/L	58	<1	1.45	9.5	-	1,000
Iron	ug/L	58	<20	<20	290	-	300
Lead	ug/L	58	<1	<1	1.37	-	-
Lithium	ug/L	58	<5	5.70	12	-	-
Manganese	ug/L	58	<1	1.34	1,330	-	50
Mercury	ug/L	58	<1	<1	<1	2	-
Molybdenum	ug/L	58	<1	<1	4.9	-	-
Nickel	ug/L	58	<1	2.30	23.1	100	-
Selenium	ug/L	58	<5	<5	<5	50	-
Silver	ug/L	58	<1	<1	<1	-	100
Thalium	ug/L	58	<1	<1	<1	2	-
Vanadium	ug/L	58	<1	1.20	6.6	-	-
Zinc[5]	ug/L	58	<10	<10	37.2	-	5,000
Organics							
N-Nitrosodi-n-Buylamine (NDBA)	ng/L	58	<2	<2	2	-	-
Perflurooctanoic Acid (PFOA)	ng/L	58	<5	5.00	70	-	-
Perflurooctane Sulfonate (PFOS)	ng/L	58	<5	5.05	120	-	-
Perflurobuanoic Acid (PFBA)	ng/L	58	<10	<10	23	-	-

Notes:

1. Table includes data for wells near areas irrigated with water from the South County Regional Wastewater Authority (SCRWA).
2. n = the number of results for each parameter.
3. mg/L = milligrams per liter; ug/L = micrograms per liter; ng/L = nanograms per liter.
4. The minimum shown is the lowest detected value. The lowest reporting limit is shown (e.g., <5) when there are no quantified values at the lowest reporting limit.
5. For parameters with results with multiple reporting limits, the median was computed using the Maximum Likelihood Estimate (MLE) method.
6. MCL = Maximum Contaminant Level as specified in Title 22 of the California Code of Regulations. The MCL is a health-based drinking water standard.
7. SMCL = Secondary Maximum Contaminant Level, or aesthetic-based standard per DDW or US EPA.
8. If a measured parameter was not detected in any sampling events in 2017, it is not listed in the table above.

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Appendix D Santa Clara Valley Water District

Appendix E

Water Year 2017 Report for the Santa Clara and Llagas Subbasins

(Submitted to DWR in March, 2018)



Water Year 2017 Report for the Santa Clara and Llagas Subbasins

Santa Clara Valley Water District

Water Year 2017 Report for the Santa Clara and Llagas Subbasins

Prepared by:

Bassam Kassab, P.E.
Senior Water Resources Specialist

Under the Direction of:

Vanessa De La Piedra, P.E.
Unit Manager
Groundwater Management Unit

Garth Hall, P.E.
Deputy Operating Officer
Water Supply Division

Nina Hawk
Chief Operating Officer
Water Utility Enterprise

Norma J. Camacho
Chief Executive Officer

March 2018

Santa Clara Valley Water District

2017 Annual Groundwater Report

Contributors:

Chanie Abuye

Ardy Ghoreishi

Graphic Design:

Joy Lim

Emily Cheung

BOARD OF DIRECTORS

Richard P. Santos
Chair, District 3

Linda J. LeZotte
Vice Chair, District4

Barbara Keegan
District 2

Tony Estremera
District 6

John L. Varela
District 1

Nai Hsueh
District 5

Gary Kremen
District 7

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2017 Annual Groundwater Report

EXECUTIVE SUMMARY

The Santa Clara Valley Water District (District) is the Groundwater Sustainability Agency for the Santa Clara and Llagas subbasins (Basins 2-9.02 and 3-3.01, respectively) in Santa Clara County, which are sustainably managed due to the comprehensive programs described in the District's 2016 Groundwater Management Plan (Plan).[1] This Water Year 2017 Report for the Santa Clara and Llagas Subbasins provides information on groundwater conditions and management as required by the Sustainable Groundwater Management Act (SGMA).[2]

In Water Year (WY) 2017, groundwater elevation and storage conditions in both subbasins were generally very good, with recovery to pre-drought conditions. Countywide groundwater pumping was about 115,300 acre-feet (AF), providing 41 percent of the water used by county residents and businesses. Due to improved rainfall conditions and available surface water supplies, the District operated a full managed recharge program, using about 96,800 AF of local and imported water to replenish the subbasins. In-lieu recharge programs included District treated water deliveries (104,700 AF) and recycled water use (16,800 AF). Countywide water conservation programs reduced overall demands by about 72,000 AF. Managed recharge continues to be a major inflow to both subbasins, helping to maintain a balanced long-term water budget. In WY 2017, the inflows exceeded outflows, resulting in a net increase in groundwater storage of about 31,000 AF and 7,000 AF in the Santa Clara and Llagas subbasins, respectively.

In WY 2017, the District evaluated new SGMA authorities in coordination with interested stakeholders. As a result, the District is exploring a fixed charge as a potential component of groundwater production charges. The District and interested stakeholders also developed a process to respond to hypothetical worsening basin conditions. This describes the steps that would be taken prior to regulating groundwater pumping, with a focus on providing some certainty while avoiding prescriptive requirements that may not be appropriate or effective. This process was memorialized via resolution adopted by the District Board on February 27, 2018 (Appendix A). The process notes that strong programs and partnerships are expected to result in continued, sustainable conditions and are the preferred approach to address future challenges.

The District will continue to sustainably manage the Santa Clara and Llagas subbasins as a central part of our mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy. Implementation of the Plan helps ensure continue sustainability in accordance with the District Act, SGMA, and District Board policy to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion."

2017 Annual Groundwater Report

[1] This Plan was submitted to the Department of Water Resources as an Alternative to a Groundwater Sustainability Plan. Per state requirements, an annual report must be submitted by April 1 of each year following District adoption of the Plan.

[2] The District produces a comprehensive Annual Groundwater Report based on the calendar year. This report provides detailed information on groundwater levels, storage, land subsidence and groundwater quality conditions, and is posted to the District website at: https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater.

CHAPTER 1 – INTRODUCTION

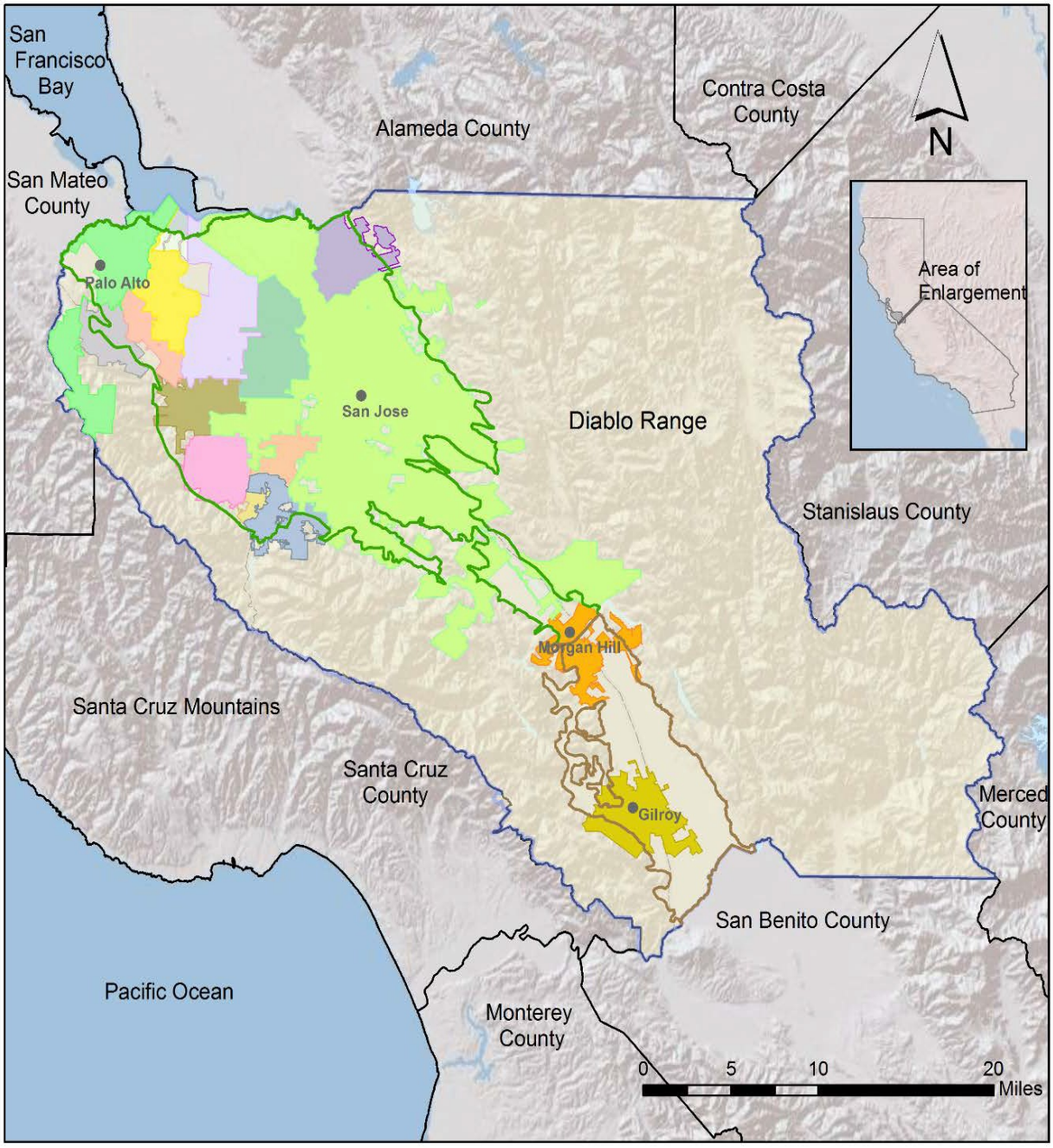
For nearly 90 years, the Santa Clara Valley Water District (District) has managed groundwater in the county under the District Act.[3] In December 2016, the District submitted its Board-adopted 2016 Groundwater Management Plan (Plan)[4] to the Department of Water Resources (DWR) as an Alternative to a Groundwater Sustainability Plan under the Sustainable Groundwater Management Act (SGMA). The District's comprehensive groundwater management programs and investments described in the Plan have resulted in sustainable groundwater conditions for many decades, and will ensure groundwater resources are sustainable far into the future.

Under the California Code of Regulations Title 23, Division 2, Chapter 1.5, Subchapter 2, Article 7, §356.2, each agency shall submit an annual report to DWR by April 1 of each year following adoption of the Plan. This report for Water Year (WY) 2017 covers the Santa Clara Subbasin (DWR Basin 2-9.02) and the Llagas Subbasin (Basin 3-3.01), which are managed in their entirety by the District. Figure 1 shows the location of the two groundwater subbasins.

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[3] Santa Clara Valley Water District Act, Water Code Appendix, Chapter 60.
[4] https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

Figure 1. Location Map



CHAPTER 2 – GROUNDWATER ELEVATION DATA

The District tracks groundwater elevations, groundwater quality, and land subsidence through a countywide groundwater monitoring program. The District collected monthly groundwater elevation readings at 174 wells in the Santa Clara Subbasin and 58 wells in the Llagas Subbasin in WY 2017. Furthermore, water retailers shared groundwater elevation data at around 100 wells with the District. While this report provides a summary of water levels at individual wells, all available countywide groundwater elevation data are accessible through the District website.[5] The District also regularly uploads groundwater elevation data to the California Statewide Groundwater Elevation Monitoring (CASGEM) program database.

Groundwater elevation contour maps for the Santa Clara and Llagas subbasins and related measurement locations are presented in Figures 2 and 3 for Spring 2017 and Fall 2017, respectively.[6] These contours represent the principal aquifer within the subbasins. Seasonal high groundwater conditions typically occur in March or April, with seasonal lows in September or October. The spring and fall maps were created using the water level readings measured closest to March 31, 2017 and September 30, 2017, respectively.

This report presents historical groundwater elevation data from 11 selected wells in the Santa Clara and Llagas subbasins (Figure 4); these monitoring wells are spatially distributed within the two subbasins and various cities in the county. Hydrographs for these wells show the static water level trend over the period of record, which varies by well (Figure 5). Due to improved water supply conditions, continued managed recharge, and significant precipitation in the winter of 2017, groundwater elevations generally returned to pre-drought conditions in WY 2017. WY 2017 groundwater elevations remained above the historical minima and levels seen during the last major droughts of 1987-1992 and 2012-2016. Groundwater elevations were also well above District thresholds established to minimize the risk of land subsidence in the Santa Clara Subbasin throughout WY 2017.[7]

[5] https://gis.valleywater.org/GroundwaterElevations

[6] Groundwater elevations in this report use the National Geodetic Vertical Datum of 1929 (NGVD29).

[7] As described in the Plan, land subsidence was an issue historically in the central and northern Santa Clara Subbasin. See the Annual Groundwater Report for Calendar Year 2016 for a detailed discussion of subsidence monitoring: https://www.valleywater.org/your-water/where-your-water-comes-from/groundwater

Figure 2. Spring 2017 Groundwater Elevation Contours

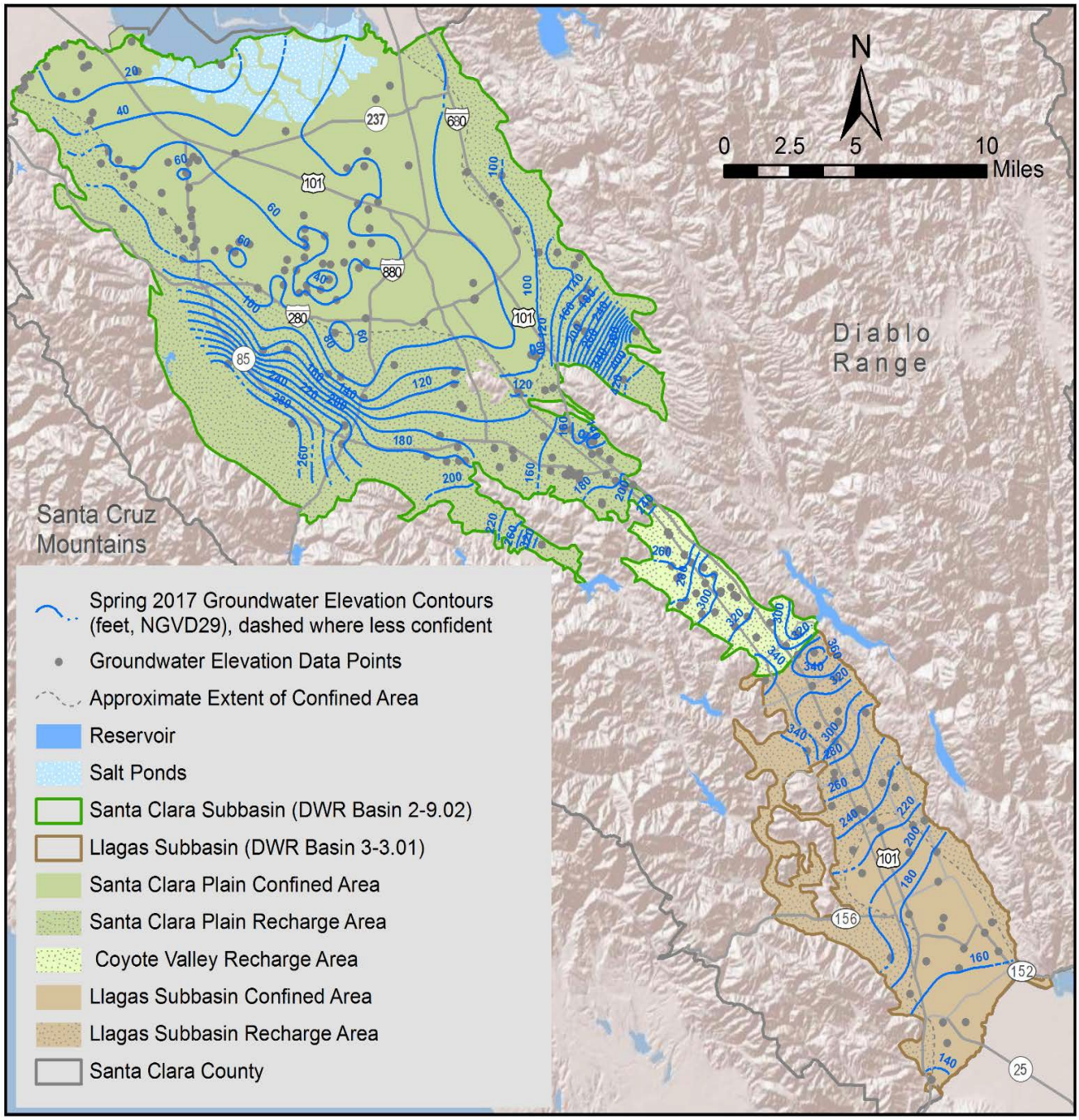


Figure 3. Fall 2017 Groundwater Elevation Contours

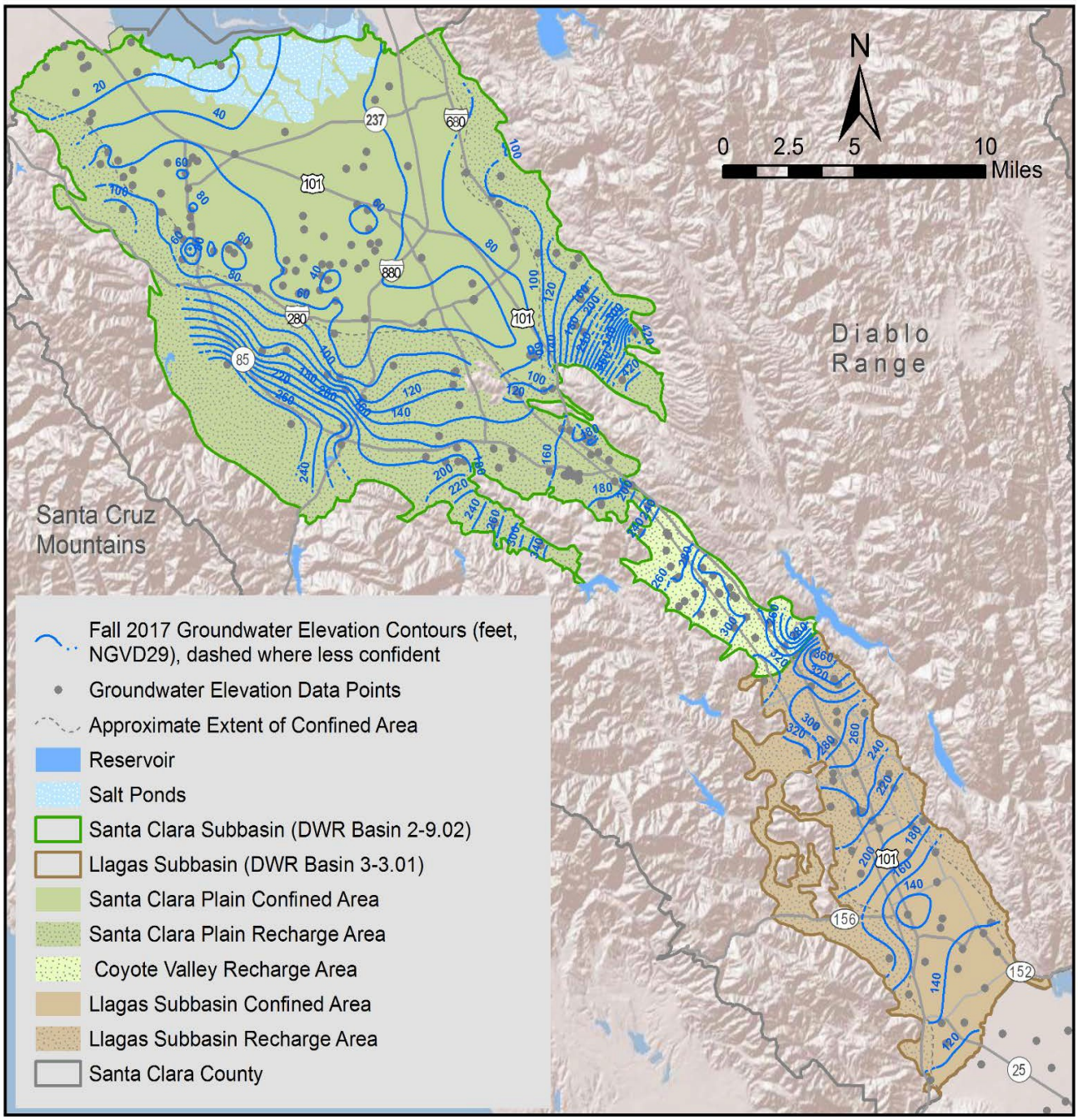


Figure 4. Locations of 11 Selected Monitoring Wells

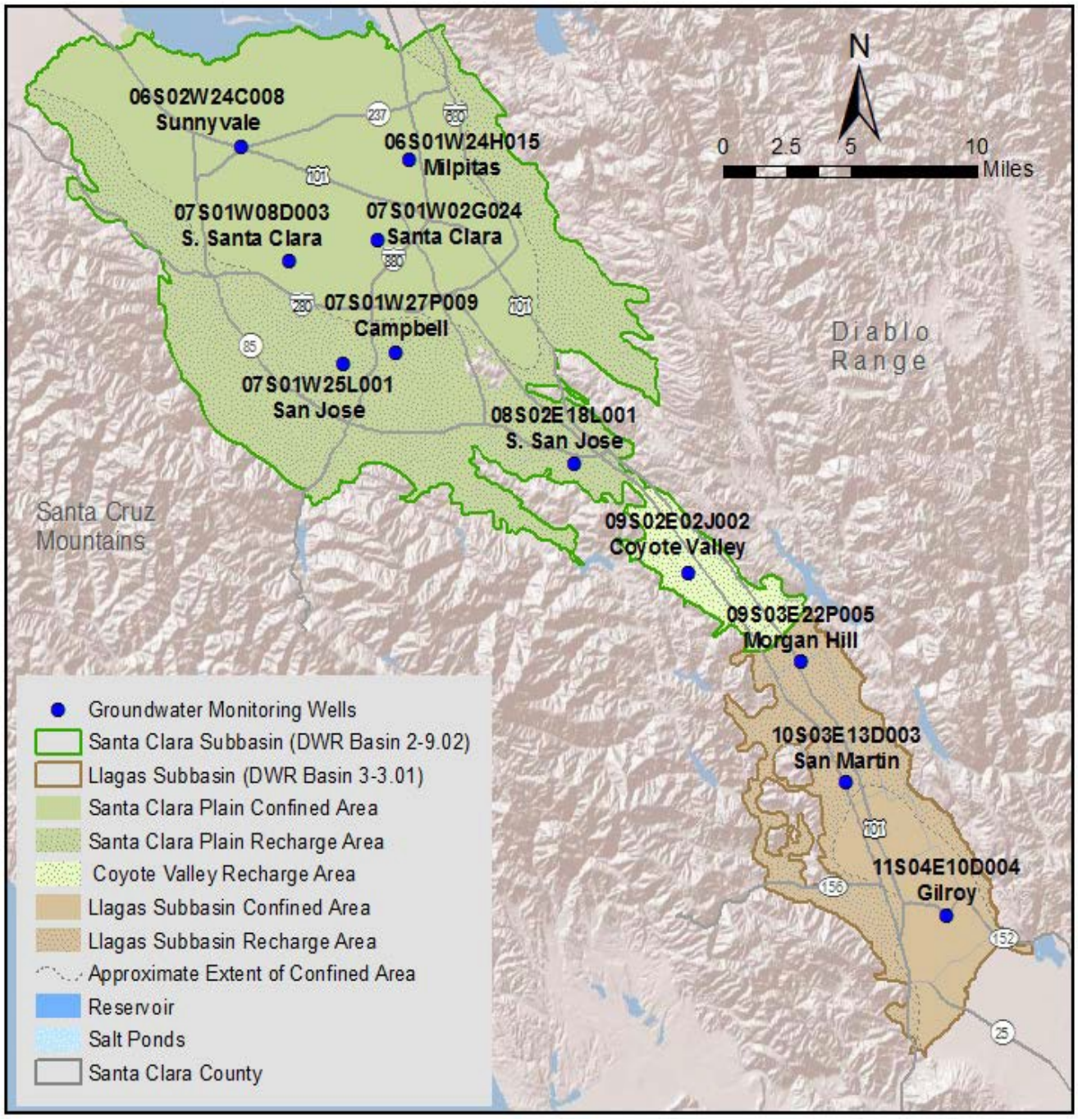
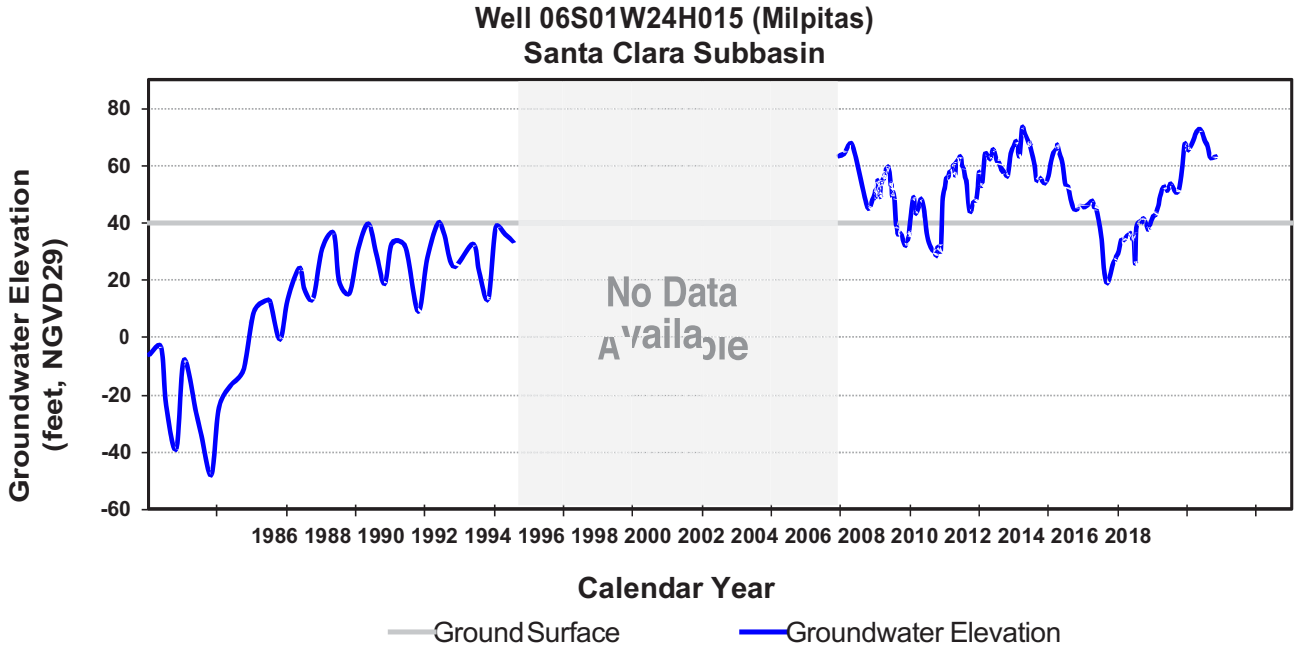
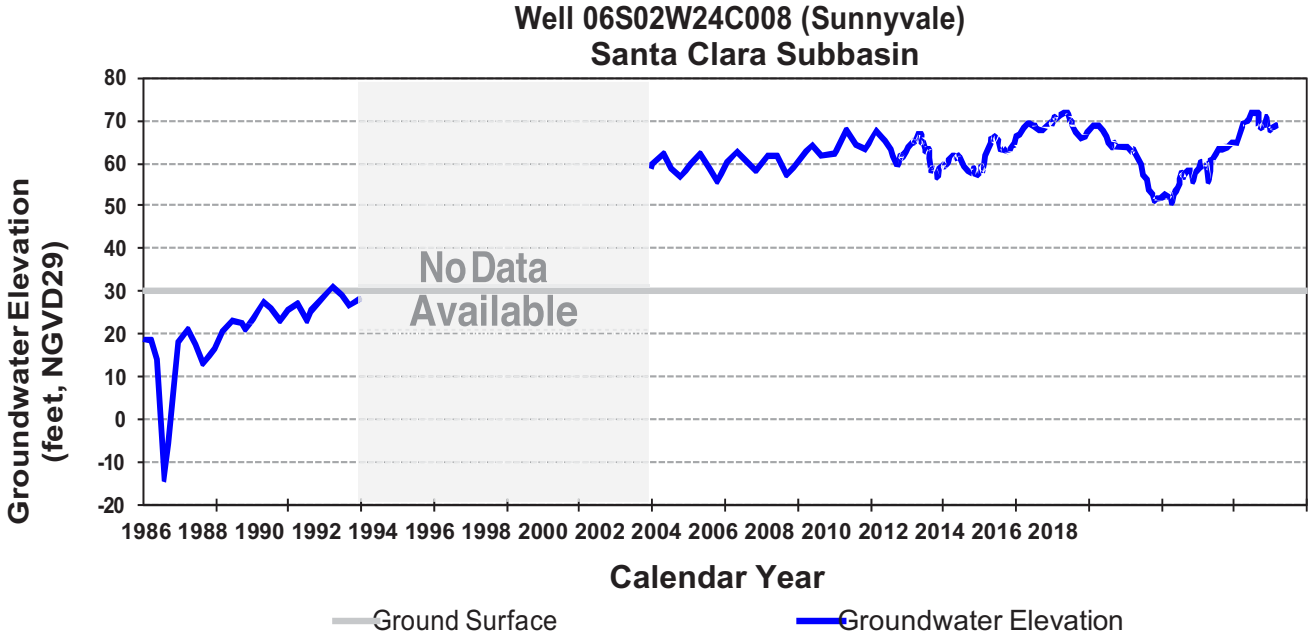


Figure 5. Hydrographs at 11 Selected Wells

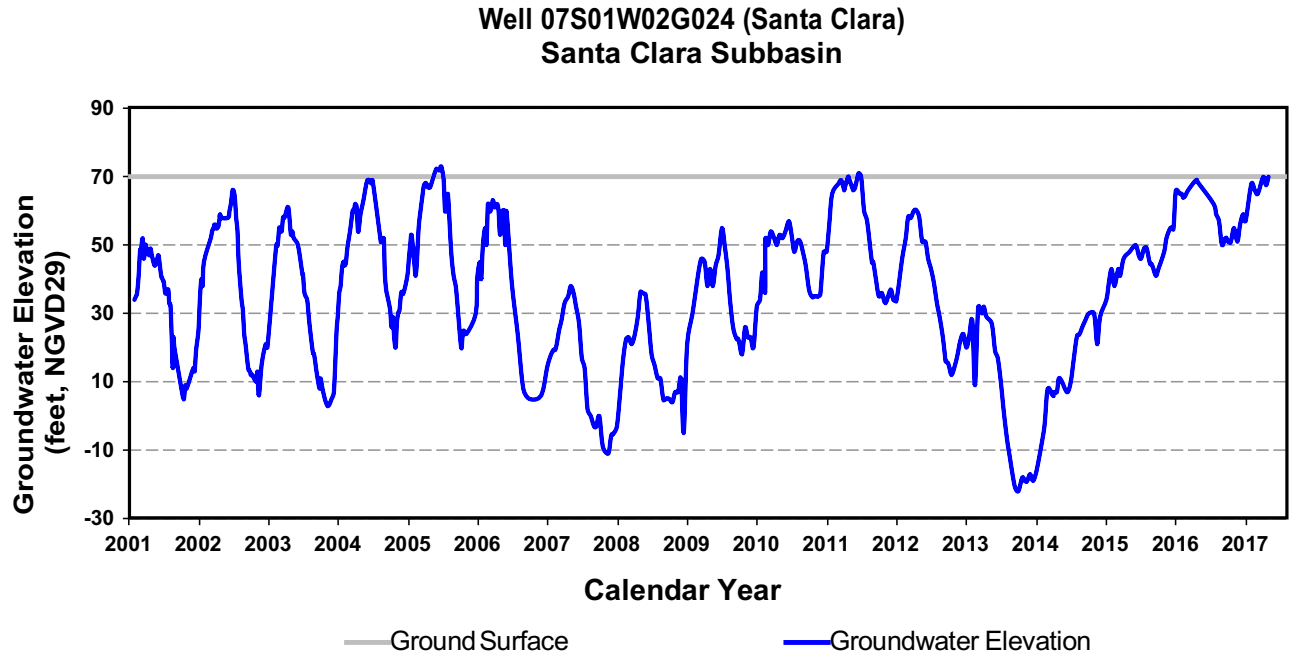


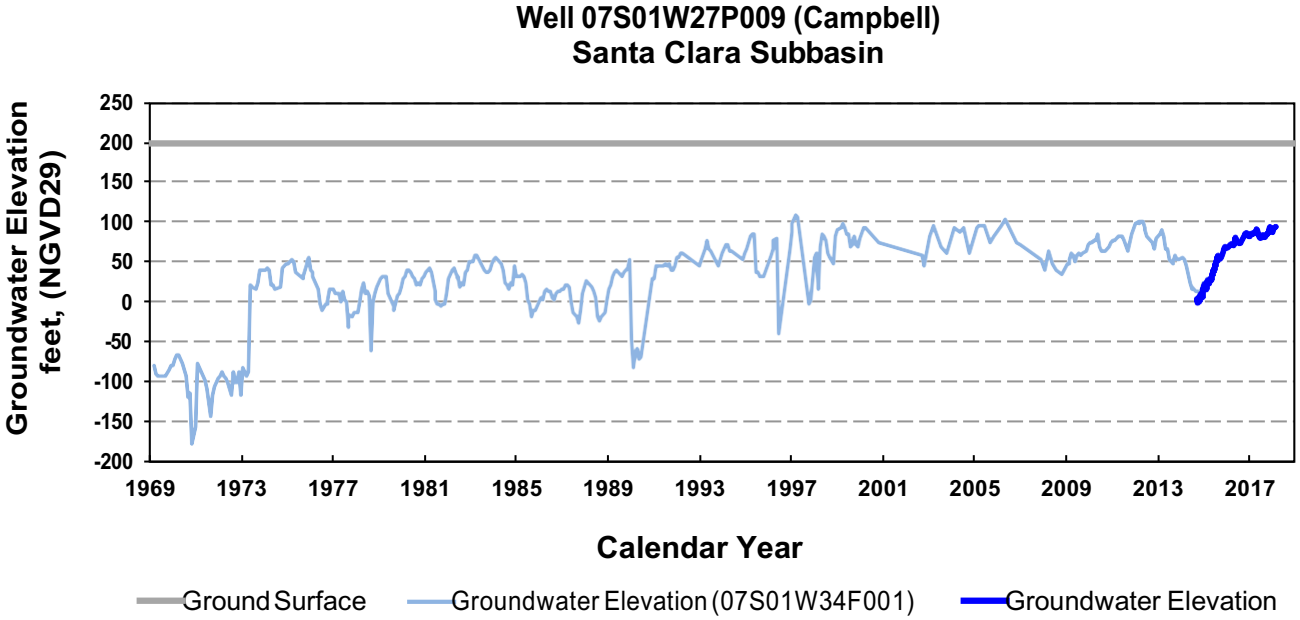
During period with no data available, well was observed to be artesian but there was no pressure gauge installed.



During period with no data available, well was observed to be artesian but there was no pressure gauge installed.

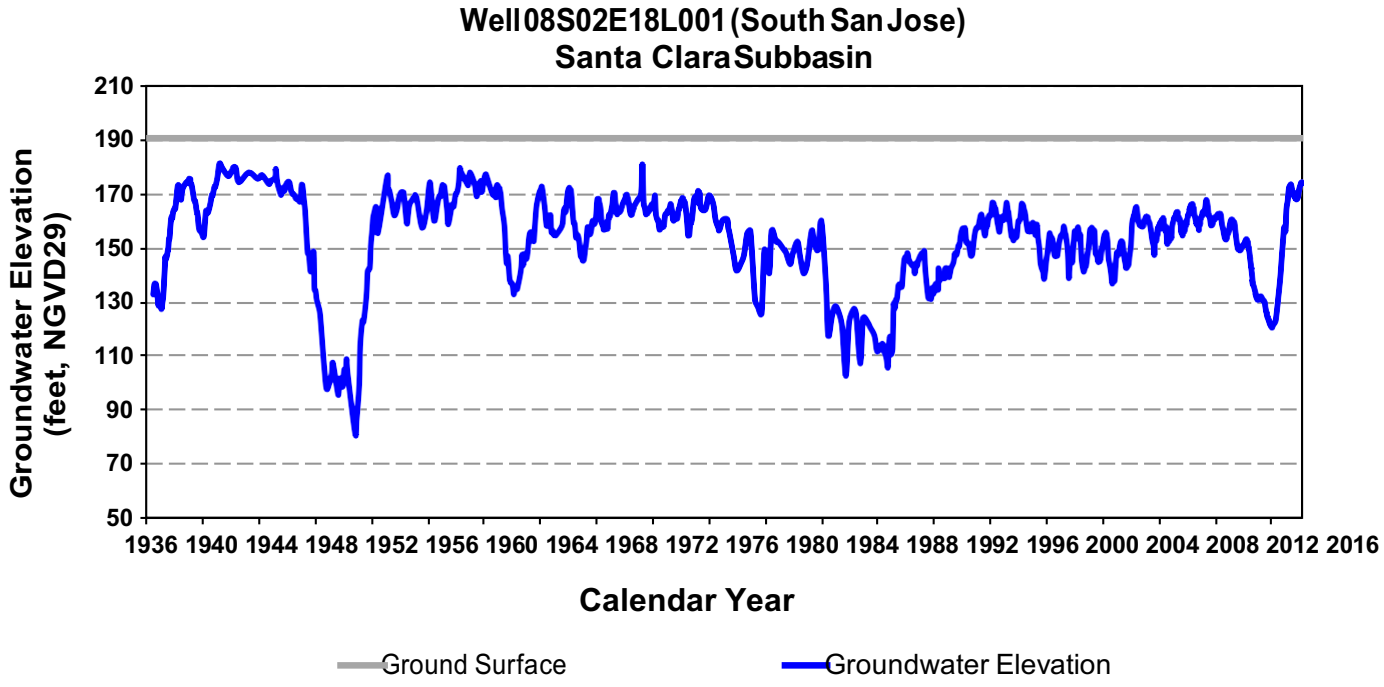
Figure 5. Hydrographs at 11 Selected Wells (continued)





The Campbell well was replaced in August 2015 with a nearby well with similar water level history.

Figure 5. Hydrographs at 11 Selected Wells (continued)



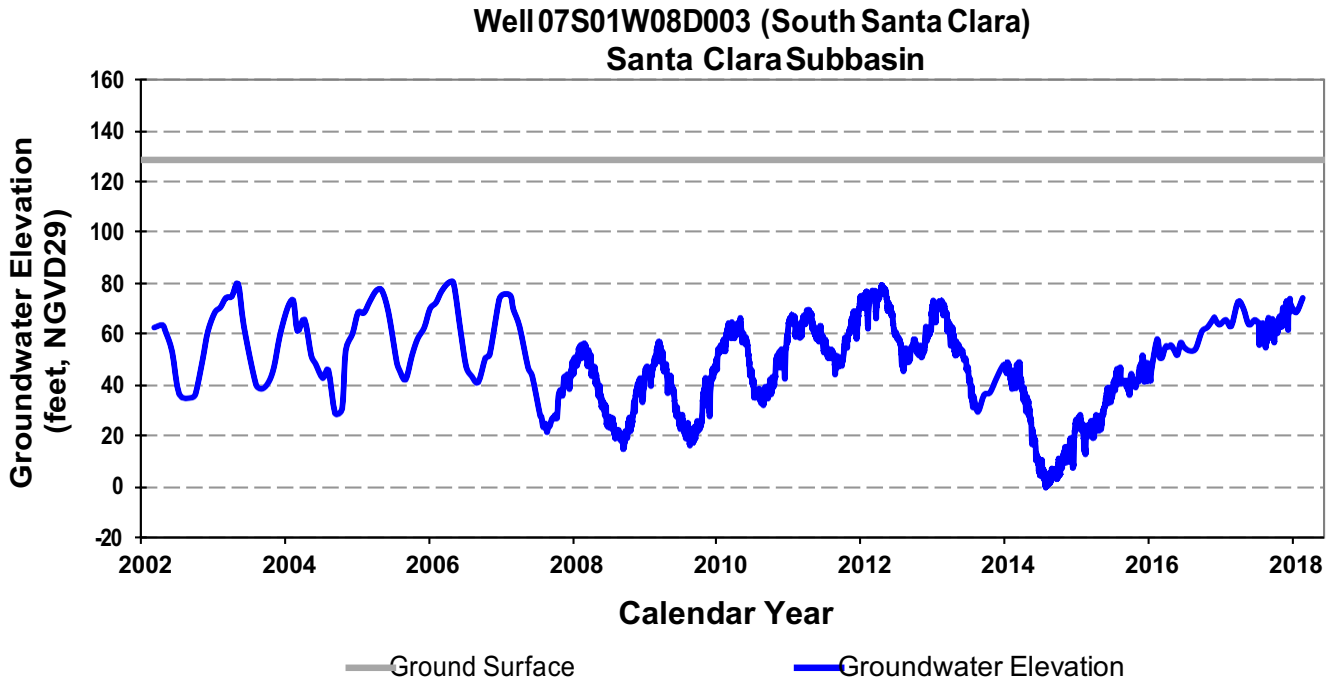
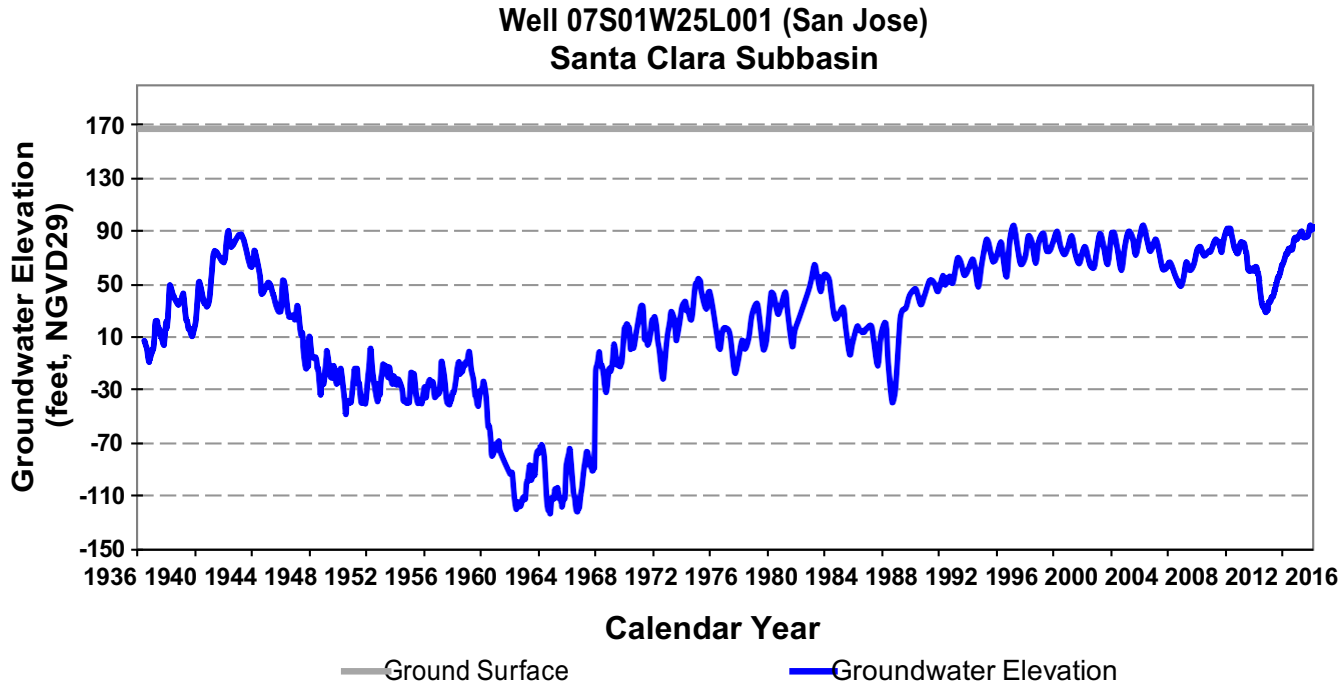


Figure 5. Hydrographs at 11 Selected Wells (continued)



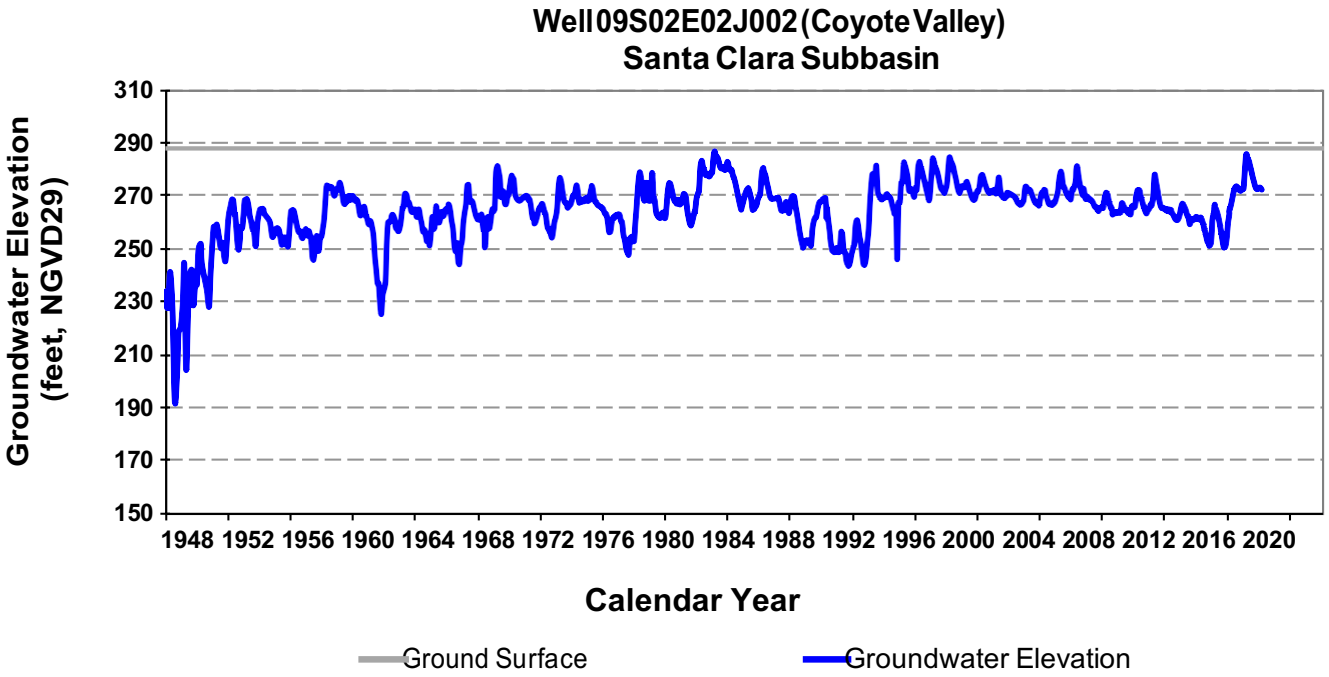
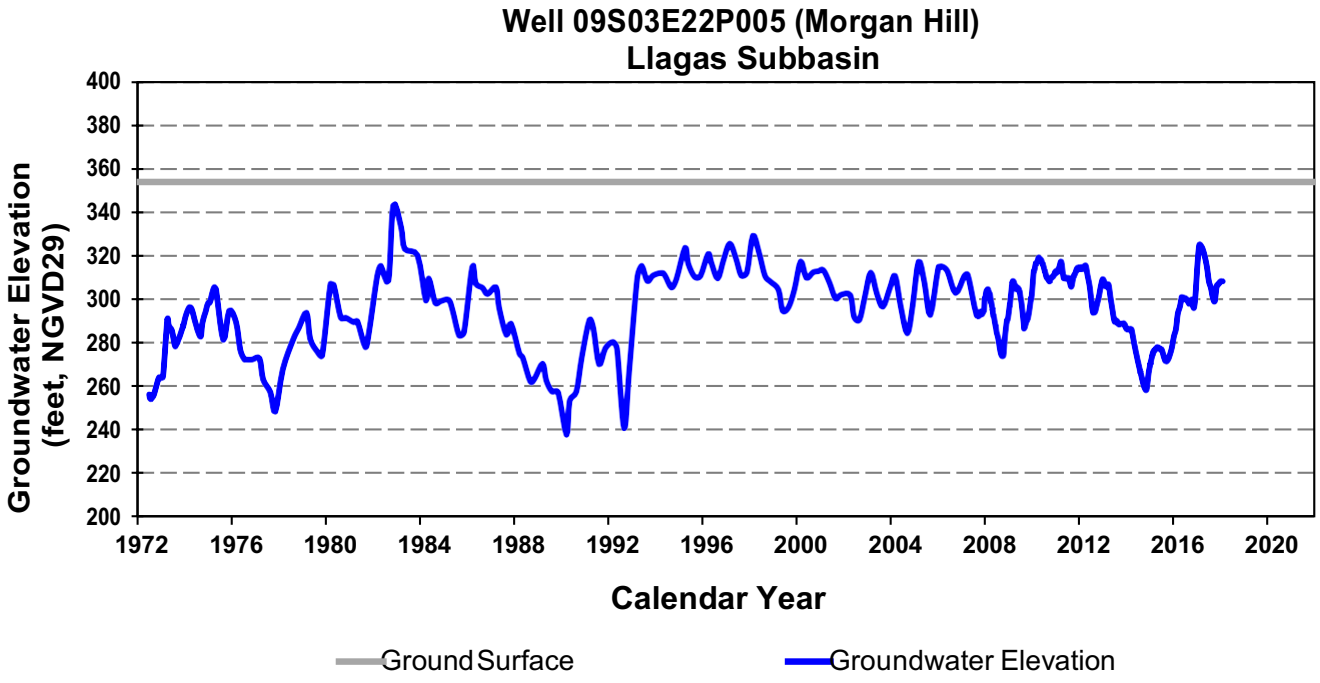


Figure 5. Hydrographs at 11 Selected Wells (continued)



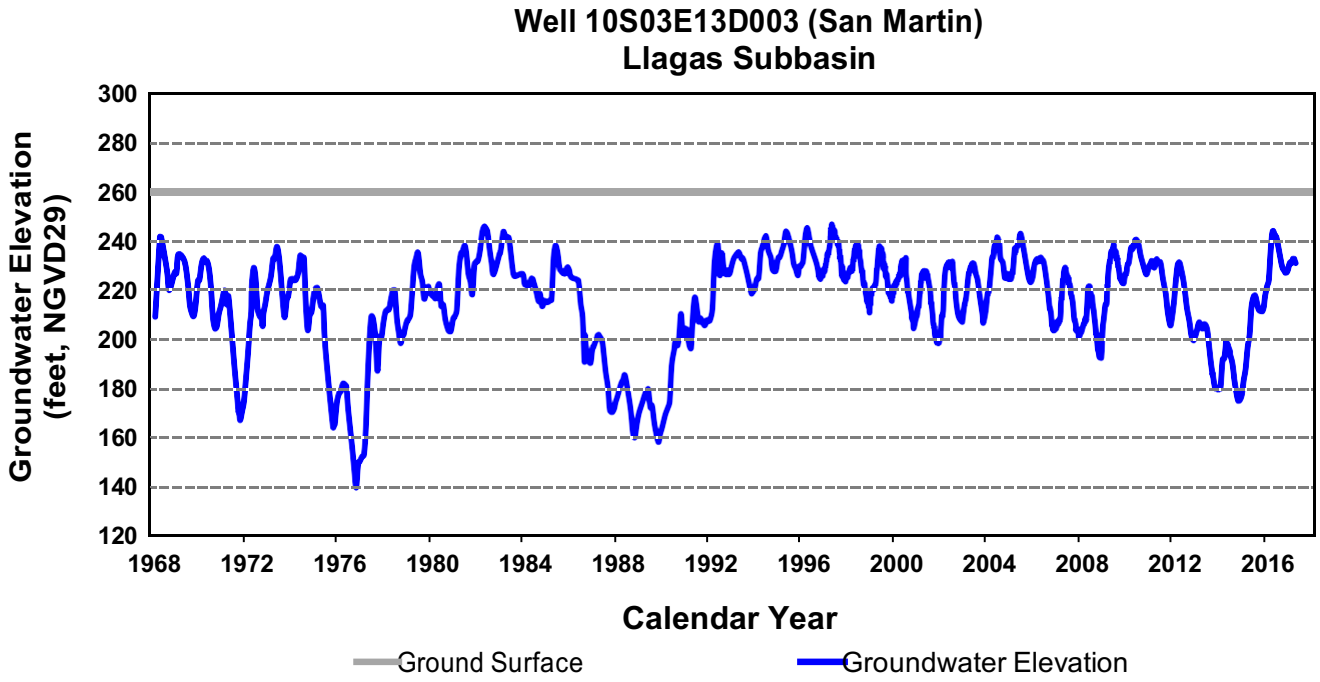
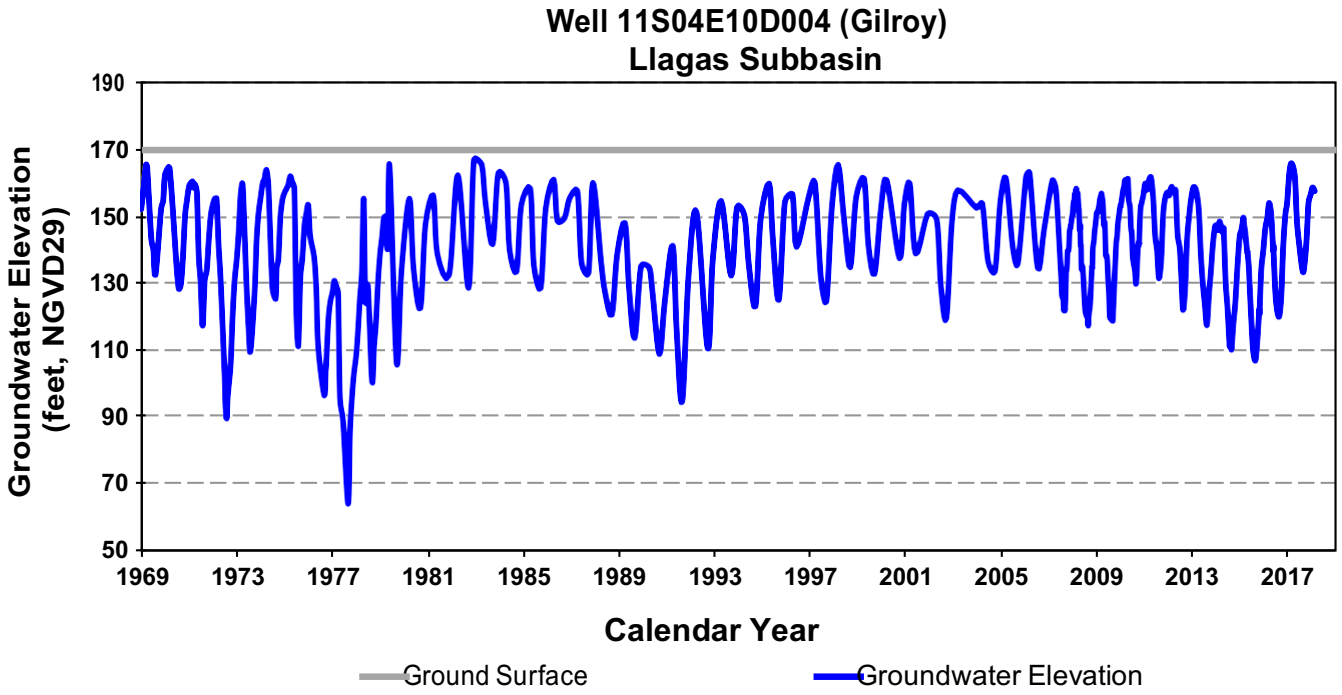


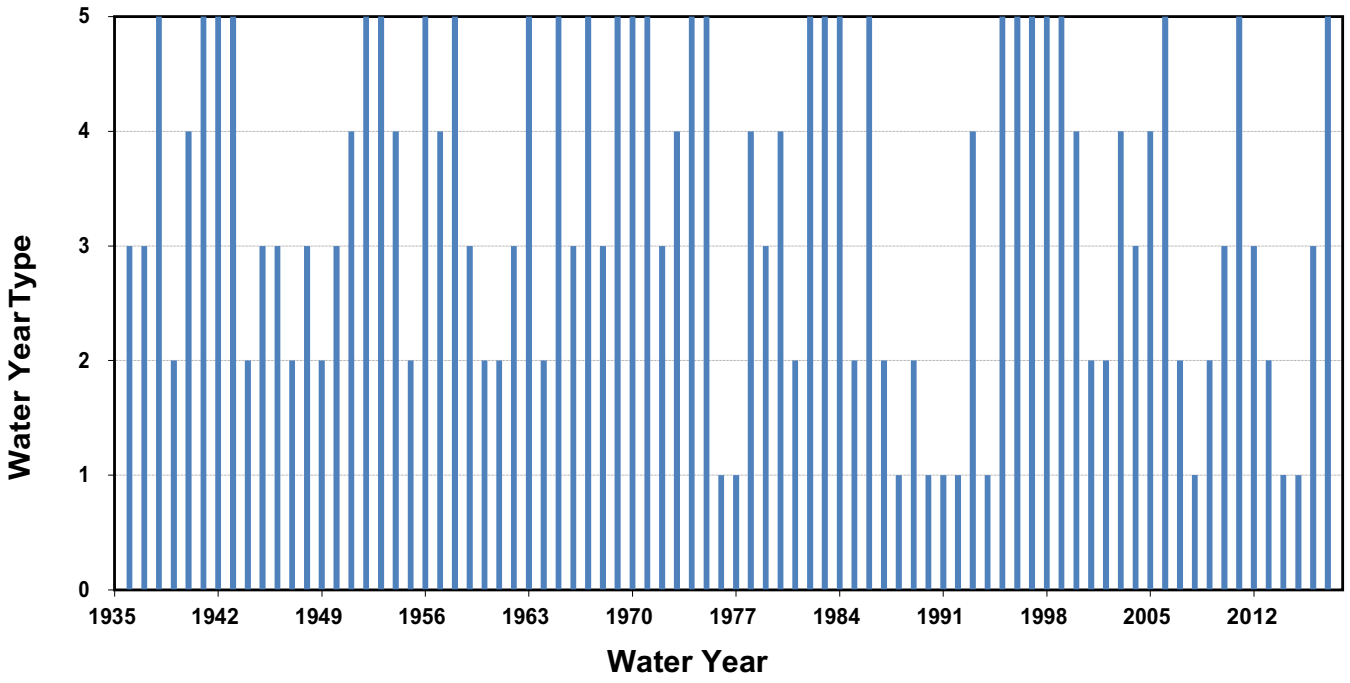
Figure 5. Hydrographs at 11 Selected Wells (continued)



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WY 2017 was a wet year per the DWR Sacramento River Index (SRI). The District uses historical SRI water year types (Figure 6) to model hydrologic conditions in Santa Clara County as it reflects conditions in the Sierra and the Sacramento-San Joaquin Delta that influence the District's imported water deliveries. Rainfall stations within Santa Clara County confirm that the rainfall season from July 1, 2016 to June 30, 2017 was wetter than the historical average. For instance, rainfall in downtown San Jose (Station 131) was approximately 17.2 inches or 120 percent of average.

Figure 6. Water Year Types from WY 1936 to 2017 – Sacramento River Index (SRI)



Water Year Types per DWR SRI: 1 (Critical); 2 (Dry); 3 (Below Normal); 4 (Above Normal); 5 (Wet)

CHAPTER 3 – WATER SUPPLY AND USE

The District manages a diverse water supply portfolio, with sources including groundwater, local surface water, imported water, and recycled water. About half of the county's water supply comes from local sources with the other half from imported sources. Imported water includes the District's State Water Project (SWP) and Central Valley Project (CVP) contract supplies, and supplies delivered by the San Francisco Public Utilities Commission (SFPUC) to cities in northern Santa Clara County. Local sources include natural groundwater recharge and surface water supplies. A small but growing portion of the county's water supply is recycled water.

District surface water supplies are distributed to managed recharge facilities in the Santa Clara and Llagas subbasins, drinking water treatment plants, local creeks for environmental needs, or directly to water users. The conjunctive management of surface water and groundwater maximizes water supply reliability, allowing the District to store surface water in local groundwater basins to help balance pumping and provide reserves for use during dry years.

3.1 Groundwater Extraction

Countywide groundwater pumping in WY 2017 was about 115,300 acre-feet (AF), providing 41 percent of the water used by county residents and businesses. Figure 7 shows the location and volume of groundwater pumping in WY 2017 in the Santa Clara and Llagas subbasins.

Groundwater in the Santa Clara Subbasin was used primarily for municipal and industrial (M&I) purposes (about 96% of pumping), with some agricultural and domestic use, mainly in the more rural Coyote Valley in the southern part of the subbasin. In the Llagas Subbasin, agricultural use was more significant, accounting for about 56% of the total pumping. While the quantity of groundwater used for domestic purposes was relatively small in the Llagas Subbasin, nearly 2,000 individual wells reported groundwater use in WY 2017. Table 1 summarizes WY 2017 pumping by subbasin, water use category, and measurement method and accuracy.

The amount of groundwater pumped from the groundwater subbasins is recorded in accordance with the District Act, which requires owners to register all wells within the District's groundwater management zones and to file production statements with the District on either an annual, semi-annual or monthly basis depending on the amount of water produced. By District Board Resolution, meters are only installed at those sites determined to be economically feasible per approved criteria or as required to facilitate the complete and accurate collection of groundwater production revenue. In the Santa Clara Plain, meters are required for facilities producing more than 4

AF of agricultural water or more than 1 AF of non-agricultural water annually. Within the Coyote Valley or Llagas Subbasin, meters are required for facilities producing more than 20 AF of agricultural water or more than 2 AF of non-agricultural water.

Metered wells extracted the vast majority (90%) of the groundwater used in WY 2017. Where meters were not used, crop factors were used to determine agricultural water use, whereas domestic use was estimated from a table of average uses.

Figure 7. WY 2017 Groundwater Pumping in the Santa Clara and Llagas Subbasins

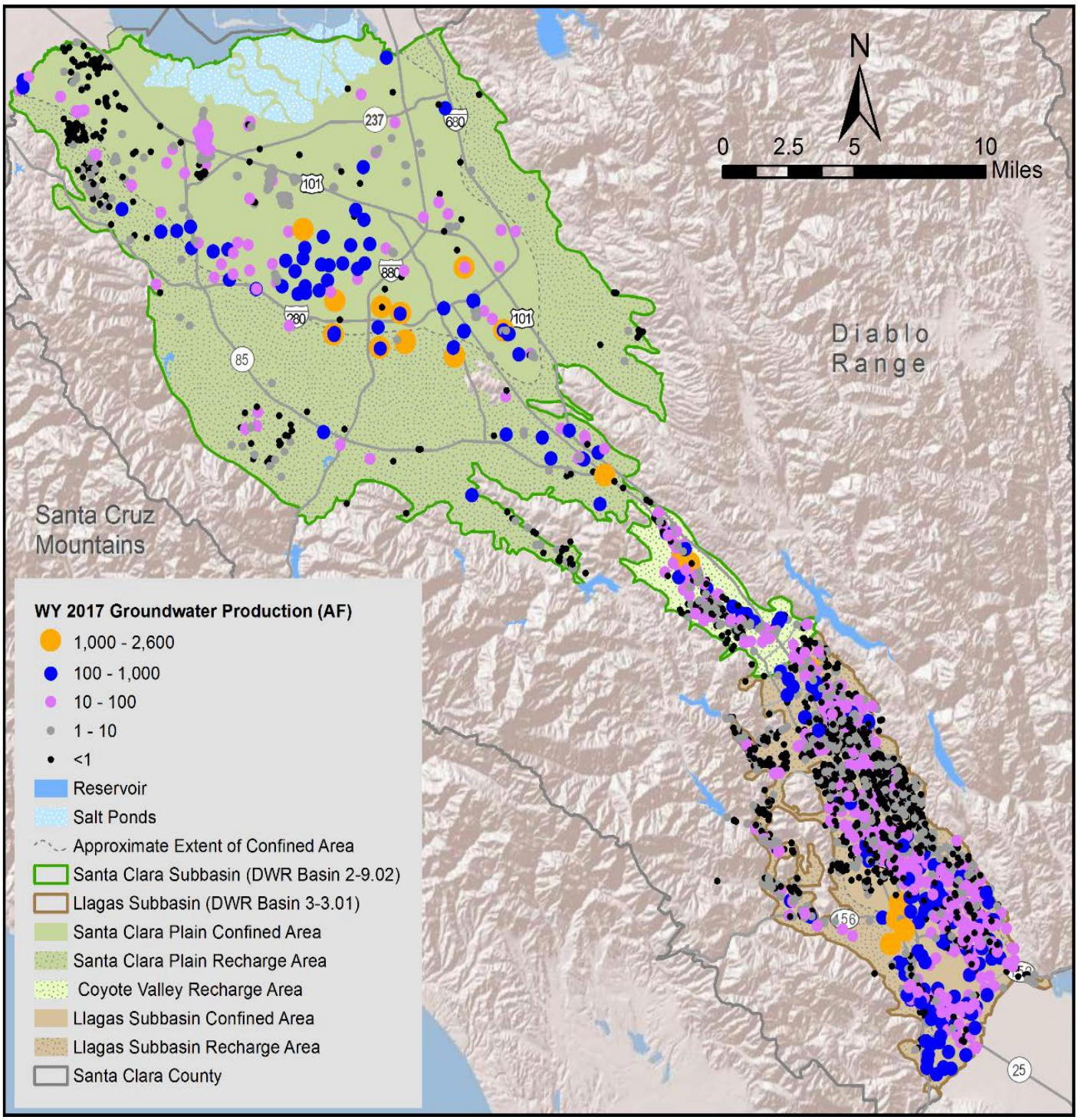


Table 1. WY 2017 Groundwater Pumping (AF) by Water Use

Water Use Sector	Measurement Method	Santa Clara Subbasin	Llagas Subbasin	Countywide Pumping	Accuracy
M&I	Metered	68,500	16,100	84,600	Within 2%
	Estimated	2,400	900	3,300	N/A
Domestic	Metered	100	200	300	Within 2%
	Estimated	100	1,000	1,100	N/A
Agricultural	Metered	2,200	16,500	18,700	Within 2%
	Estimated	900	6,400	7,300	N/A
Total		**74,200**	**41,100**	**115,300**	

Notes:

- As described above, the majority of groundwater pumping is metered. Smaller pumpers are required to report production semi-annually or annually on a fiscal year basis. Non-metered pumpers report groundwater pumping based on crop factors (agricultural use) or table of average uses (domestic use). In this table, estimated pumping shown for the water year is based on fiscal year reporting and typical pumping patterns.
- All values are rounded to the nearest hundred.

3.2 Surface Water Supply Used

In WY 2017, the District actively recharged about 96,800 AF of imported and local surface water in the Santa Clara and Llagas subbasins. The District also provided about 106,200 AF of in-lieu recharge in the form of treated water deliveries to retailers (cities and water companies) and raw surface water deliveries to customers. This is in addition to SFPUC deliveries to eight retailers overlying the Santa Clara Subbasin and recycled water deliveries by the District and four main producers in the county, which alleviate the demand on the groundwater subbasins. The District's long-term water conservation programs also saved about 72,000 AF, which further reduced the demand on groundwater.

District Managed Recharge

The District replenishes the groundwater subbasins with imported water and runoff captured in 10 local reservoirs. District recharge facilities include more than 300 acres of recharge ponds and over 90 miles of creeks. Imported sources include the SWP and the federal CVP. The use of imported or local water for managed recharge each year depends on many factors including hydrology, imported water allocations, treatment plant demands, and environmental needs. In general, a greater percentage of local water is used for recharge in wet years due to increased capture of local storm runoff in local reservoirs. In WY 2017, the District recharged about 78,900 AF of local and imported water in the Santa Clara Subbasin and about 17,900 AF in the Llagas Subbasin.

In-Lieu Use of Surface Water Supplies

District treated and raw surface water deliveries, SFPUC supplies to local retailers, and recycled water programs play a critical role in maintaining groundwater elevations and storage by reducing demands on groundwater. Table 2 summarizes the supplies from these categories in areas that were historically primarily or solely served by the two groundwater subbasins.

3.3 Total Water Use

Total water use in Santa Clara County in WY 2017 is summarized in Table 2. While the county boundary extends beyond the subbasins, the vast majority of the population and associated water use coincides with the subbasins. Water use categories are summarized in Table 2, along with their measurement methods and accuracy, water sources, and use sectors.

Table 2. Santa Clara County Water Use in AF for WY 2017

Water Use[1]	Santa Clara Subbasin	Llagas Subbasin	County-wide	Measurement Method	Accuracy	Source	Sector
Groundwater Pumped	74,200	41,100	115,300	Metered (90%) and estimated[2]	Within 2 percent (metered)	Natural recharge, managed recharge of local runoff and imported water (SWP/CVP)	M&I, domestic and agricultural[3]
District Treated Water	104,700	0	104,700	Metered	Within 2 percent	Local runoff and imported water	M&I
District Raw Surface Water Deliveries	400	1,100	1,500	Metered (95%) and estimated[2]	Within 2 percent (metered)	Local runoff and imported water	M&I, domestic and agricultural
SFPUC Supplies to Local Retailers[4]	44,200	0	44,200	Metered	Within 1.5 percent	Surface water reservoirs[5]	M&I
Recycled Water	15,000	1,800	16,800	Metered	Variable[6]	Treated wastewater	M&I and agricultural
Total[7]	**238,500**	**44,000**	**282,500**				

[1] All water use values are rounded to the nearest hundred.

[2] Production from some smaller wells and raw surface water users is estimated using a table of average uses or crop factors.

[3] Groundwater use by sector is shown in Table 1.

[4] San Francisco Public Utilities Commission (SFPUC) supplies water to eight (8) retailers in Santa Clara County and NASA-AMES.

[5] SFPUC primary sources are surface water reservoirs with runoff mainly from the Hetch Hetchy watershed and also from the Alameda watershed. More information is available at: https://sfwater.org/index.aspx?page=355.

[6] Recycled water meter accuracy varies as each of the four producers within the county uses different methods to measure

production and delivery of recycled water.

[7] Local water rights used by the San Jose Water Company (SJWC) and Stanford within the Santa Clara Subbasin are not reflected in the total. In WY 2017, SJWC local water rights amounted to 1,700 AF. Stanford has historically used between 200 and 1,000 AFY.

3.4 Change in Groundwater Storage

Due to good water supply conditions, robust managed recharge, and continued lower groundwater use since the drought, the District estimates storage in the two subbasins increased by about 38,000 AF in WY 2017 compared to WY 2016. Storage in the Santa Clara Subbasin and Llagas subbasins increased by about 31,000 AF and 7,000 AF, respectively.

Figure 8 depicts the change in groundwater level from October 2016 to September 2017 at more than 200 water level wells in the Santa Clara Subbasin and more than 55 wells in the Llagas Subbasin, respectively. The corresponding change in storage, as estimated from the District's groundwater flow models, is also shown.

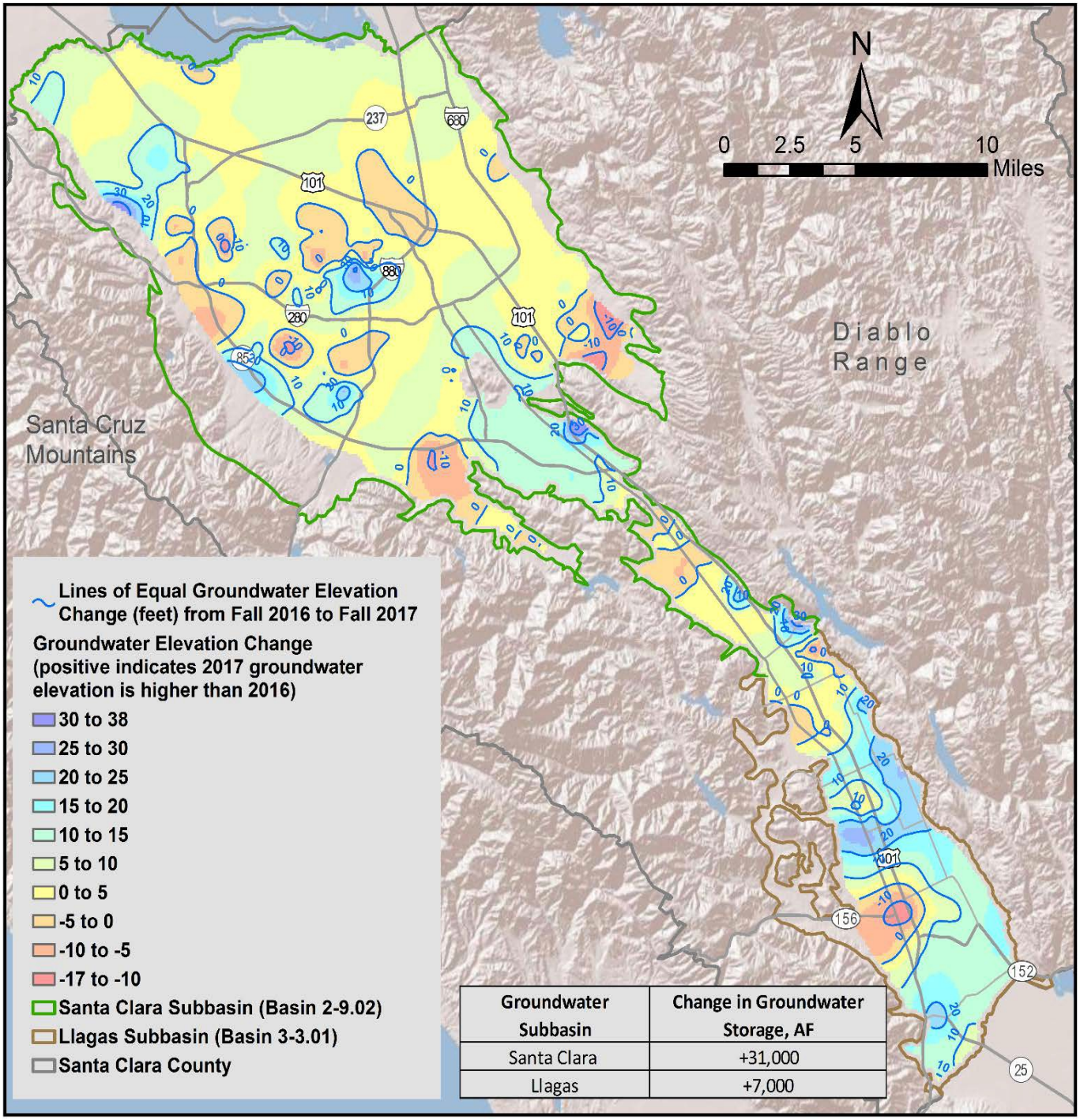
Figures 9 and 10 present the water year type, groundwater use, annual change in groundwater storage, and cumulative change in groundwater storage for the Santa Clara and Llagas subbasins, respectively, through WY 2017.

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2017 Annual Groundwater Report

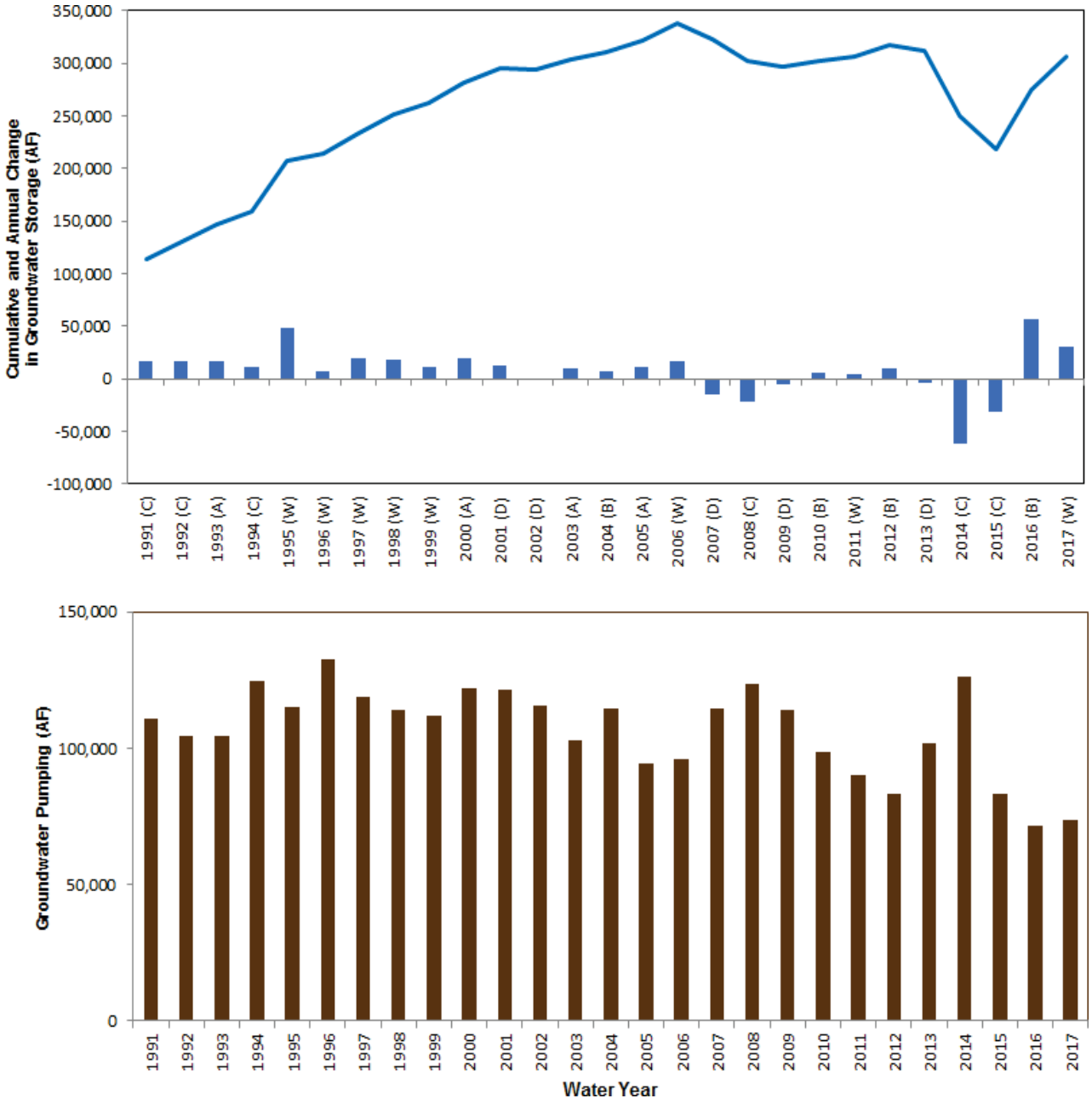
Appendix E Santa Clara Valley Water District

Figure 8. Change in Groundwater Elevation and Storage from October 2016 to September 2017



Groundwater Subbasin	Change in Groundwater Storage, AF
Santa Clara	+31,000
Llagas	+7,000

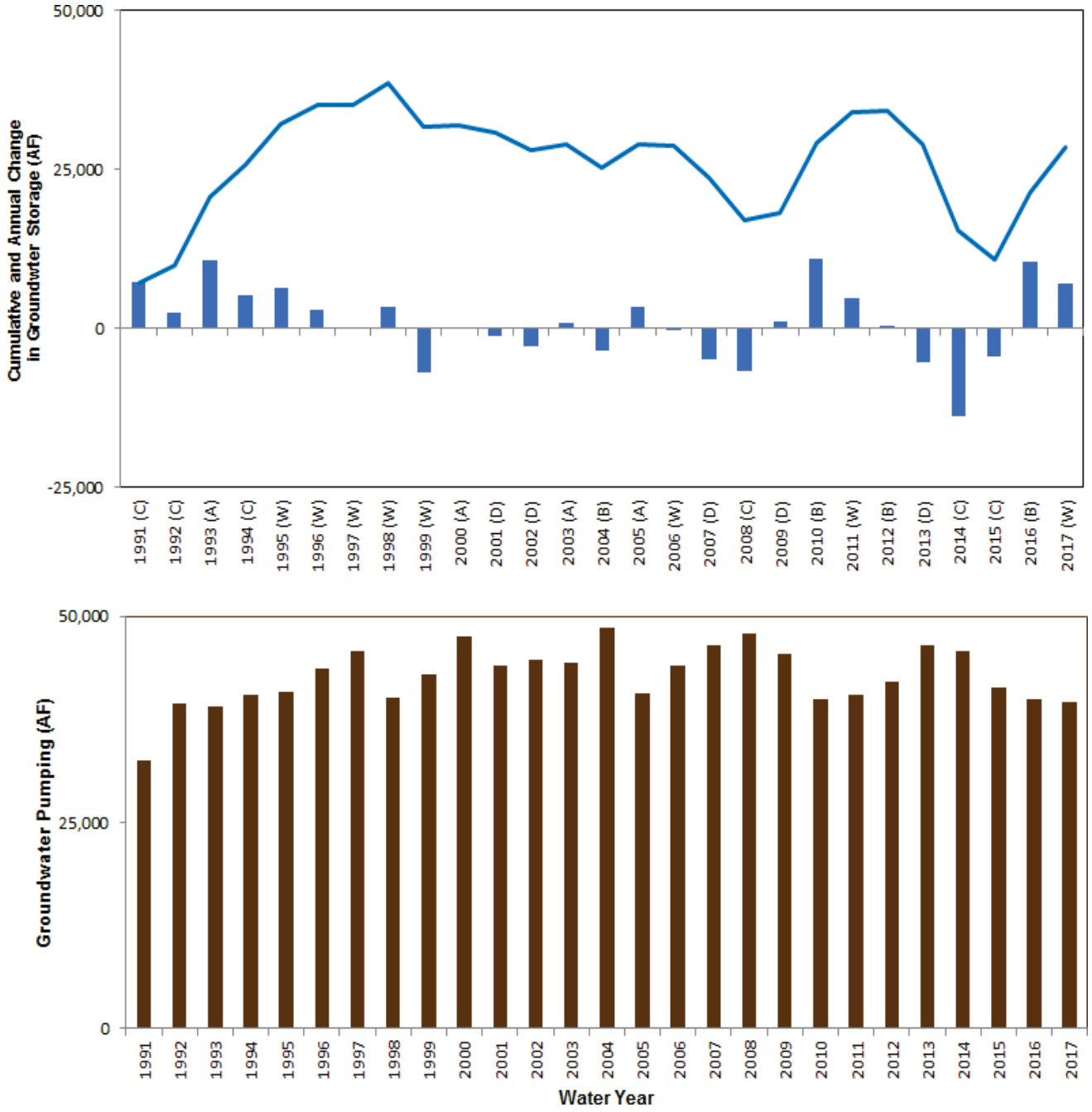
Figure 9. Groundwater Use and Change in Storage in the Santa Clara Subbasin



Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because the District estimates Santa Clara Subbasin storage using two numerical models. The Santa Clara Plain model for the northern Santa Clara Valley begins in 1970 while the Coyote Valley model for the southern part of the subbasin begins in 1991 as the District did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year.

Figure 10. Groundwater Use and Change in Storage in the Llagas Subbasin



Notes:

- DWR SRI water year types are: Critical (C), Dry (D), Below Normal (B), Above Normal (A), and Wet (W).
- The storage graph begins in 1991 because the District estimates Llagas Subbasin storage using a numerical model that begins in 1991 as the District did not begin managing that area until the late 1980s.
- Most groundwater pumping is reported monthly and is reported here by water year. However, pumpers that report semi-annually or annually provide data based on the fiscal year (July 1 to June 30). For these reporters, groundwater pumping shown in this figure represents the fiscal year, which is presumed to be similar to the water year.

CHAPTER 4 – PLAN IMPLEMENTATION

The District continues to implement the comprehensive conjunctive management, groundwater monitoring, and groundwater protection programs described in the Plan. As a result, conditions in the Santa Clara and Llagas subbasins remained sustainable. In fact, groundwater levels and storage in the two subbasins have recovered to pre-drought conditions due to proactive drought response, improved water supplies, and significant recharge.

The District undertook several efforts related to SGMA compliance in WY 2017, including submittal of the 2016 Plan to DWR as an Alternative prior to the January 1, 2017 statutory deadline, and response to public comments. Throughout 2017, the District explored new SGMA authorities in coordination with interested stakeholders through the Board's Water Conservation and Demand Management Committee (Committee). Because the District Act provides broad authorities, these additional SGMA authorities relate to the ability to regulate pumping or well construction, and the ability to impose various types of fees. Nine publicly-noticed Committee meetings between December 2016 and December 2017 provided a transparent forum for discussion with interested stakeholders on how and when these authorities may be used. As a result, the District is further exploring the potential to implement a fixed charge as a component of groundwater production charges, which are currently volumetric charges. This would potentially reduce volatility in rates and revenues based on changes in water use.

The potential regulation of pumping or well construction, a complex and controversial topic, was discussed extensively through Committee meetings. Existing groundwater management programs and strong partnerships with large pumpers are expected to result in continued sustainable conditions and are the preferred way to address future challenges. However, pumping regulation may be needed in the future to address undesirable results should they occur. The primary SGMA-related work product from the Committee meetings was a process to describe the fundamental approach to respond to hypothetical worsening basin conditions. This includes the steps that would be taken prior to implementing SGMA authorities to regulate groundwater pumping, with a focus on providing some certainty on the process, while avoiding prescriptive requirements that may not be appropriate or effective. This process was memorialized via a resolution adopted by the District Board on February 27, 2018 (Appendix A).

The District will continue to submit annual reports required under SGMA to DWR by the April 1 deadline. The District also publishes a comprehensive annual groundwater report each June with more detailed information on pumping, recharge, water balance, groundwater levels and storage, land subsidence and groundwater quality for the previous calendar year. The most recent report, the Annual Groundwater Report for Calendar Year 2016, is posted on the

District website.

Ensuring continued groundwater sustainability is central to the District mission to provide Silicon Valley a safe, clean water supply for a healthy life, environment, and economy. As such, the District will continue to "aggressively protect groundwater from the threat of contamination and maintain and develop groundwater to optimize reliability and to minimize land subsidence and salt water intrusion," in accordance with Board policy.

Appendix A

Resolution Memorializing the Process to Regulate Groundwater Extraction Under the Sustainable Groundwater Management Act, if Needed

RESOLUTION NO. 18- 04

RESOLUTION MEMORIALIZING THE PROCESS TO REGULATE GROUNDWATER EXTRACTION UNDER THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT, IF NEEDED

WHEREAS, the Santa Clara Valley Water District Act (California Water Code Appendix, Chapter 60) provides the District with broad groundwater management authority, including the authority to protect, spread, store, retain, and cause water to percolate in the soil within Santa Clara County; and

WHEREAS, on September 16, 2014, the Sustainable Groundwater Management Act (SGMA) was signed into law and adopted into the California Water Code, commencing with Section 10720; and

WHEREAS, Water Code Section 10720.1 states that, in enacting SGMA, the intent of the legislature is to provide for the sustainable management of groundwater basins, to enhance local management of groundwater consistent with rights to use or store groundwater, to establish minimum standards for sustainable groundwater management, to provide local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater, and to achieve other listed intents; and

WHEREAS, on May 24, 2016, the District Board of Directors adopted Resolution 16-51 on the Decision to Become the Groundwater Sustainability Agency (GSA) for the Santa Clara and Llagas Subbasins; and

WHEREAS, on June 13, 2017, the District Board of Directors adopted Resolution 17-38 on the Decision to Become the GSA for the Portions of the Hollister and San Juan Bautista Subbasins Located Within Santa Clara County; and

WHEREAS, Water Code Section 10733.6(b)(1) identifies a plan developed pursuant to Part 2.75 (commencing with Section 10750) or other law authorizing groundwater management as an acceptable alternative to a Groundwater Sustainability Plan; and

WHEREAS, the 2016 Groundwater Management Plan (GWMP) describes the District's comprehensive framework to ensure continued, sustainable groundwater conditions in the Santa Clara and Llagas Subbasins; and

WHEREAS, on November 22, 2016, the District Board of Directors adopted the GWMP through Resolution 16-78; and

WHEREAS, the District submitted the GWMP to the California Department of Water Resources as an alternative pursuant to SGMA; and

WHEREAS, the GWMP acknowledges new authorities granted by SGMA, including the potential to regulate groundwater extraction, control well spacing or operation, and collect different types of fees, within the constraints identified in SGMA; and

Resolution Memorializing the Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed — Resolution No. 18-04

WHEREAS, the existing groundwater management framework, which includes coordination with water retailers and other stakeholders, is expected to support continued, sustainable groundwater conditions; and

WHEREAS, the District Board of Directors directed the Water Conservation and Demand Management Committee (Committee) to engage stakeholders in evaluating the new SGMA authorities as potential tools that may be needed to ensure continued sustainability; and

WHEREAS, the Committee engaged water retailers and other interested stakeholders during nine publicly-noticed meetings between December 2016 and December 2017; and

WHEREAS, the Committee considered stakeholder input in developing the Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed, attached hereto as Exhibit A; and

WHEREAS, the Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed, describes the approach to respond to worsening basin conditions, including the steps that would be taken prior to implementing SGMA authorities to regulate extraction.

NOW, THEREFORE BE IT RESOLVED that the Board of Directors of the Santa Clara Valley Water District:

1. Hereby adopts the Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed; and

2. All the recitals in this Resolution are true and correct and the District so finds, determines, and represents.

PASSED AND ADOPTED by the Board of Directors of the Santa Clara Valley Water District by the following vote on February 27, 2018:

AYES: Directors N. Hsueh, T. Estremera, B. Keegan, G, Kremen, L. LeZotte, J. Varela, R. Santos

NOES: Directors None

ABSENT: Directors None

ABSTAIN: Directors None

SANTA CLARA VALLEY WATER DISTRICT

By: _____

RICHARD P. SANTOS
Chair/Board of Directors

ATTEST: MICHELE L. KING, CMC

_____
Clerk/Board of Directors

Resolution Memorializing the Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed — Resolution No. 18-04

EXHIBIT A COVERSHEET

PROCESS TO REGULATE GROUNDWATER EXTRACTION UNDER THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT, IF NEEDED

No. of Pages:	6
Exhibit Attachment:	Attachment 1: Process to Regulate Groundwater Extraction under the Sustainable Groundwater Management Act, if Needed

Resolution No. 18-04

PROCESS TO REGULATE GROUNDWATER EXTRACTION UNDER THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT, IF NEEDED

INTRODUCTION

The Santa Clara Valley Water District (District) has sustainably managed the Santa Clara and Llagas Subbasins for many decades under the authority of the District Act. In 2014, the Sustainable Groundwater Management Act (SGMA) was enacted as California's first comprehensive, statewide regulatory program for groundwater. SGMA provides Groundwater Sustainability Agencies (GSAs), like the District, with various authorities to manage groundwater.

SGMA authorities include the ability to regulate pumping and assess different types of groundwater charges. These authorities have been discussed in various meetings of the District Board of Directors (Board) Water Conservation and Demand Management Committee (Committee) in an open forum and with input from interested stakeholders.

The existing, proven groundwater management approach, which includes strong partnerships with large groundwater pumpers, is expected to result in continued, sustainable groundwater management in the future and is the preferred approach to addressing future challenges. This document describes the approach to implementing SGMA authorities to regulate groundwater extraction, should such regulation become needed in the future.

BACKGROUND

SGMA established new requirements for GSAs, including the development of Groundwater Sustainability Plans (GSPs) or prescribed Alternatives. In 2016, the District prepared the 2016 Groundwater Management Plan (GWMP), which was approved by the Board following a public hearing on November 22, 2016. The District submitted the GWMP as an alternative to a GSP to the California Department of Water Resources (DWR) in December 2016. The GWMP acknowledged the new SGMA authorities and committed the District to work collaboratively with groundwater pumpers and other stakeholders to further evaluate the authorities. The Board referred related stakeholder engagement to the Committee.

The Committee, stakeholders, and the Board have indicated interest in the use of a fixed charge as a component of the groundwater production charge, and the District will further explore this concept. Committee items on the potential regulation of pumping and related discussion with stakeholders have led to the development of this process, or implementation framework.

SGMA provides GSAs with various authorities to ensure groundwater management and use do not cause undesirable results, which are defined as one of more of the following per Water Code §10721:

1. Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon.
2. Significant and unreasonable reduction of groundwater storage.
3. Significant and unreasonable seawater intrusion.
4. Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

5. Significant and unreasonable land subsidence that substantially interferes with surface land uses.
6. Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

Per Water Code §10726.4(a), in regulating groundwater extraction, SGMA allows a GSA to:

1. impose spacing requirements on new wells and impose reasonable operating regulations on existing wells to minimize well interference by restricting or suspending well production;
2. control groundwater extractions by regulating, limiting, or suspending extractions, new well construction, well enlargement, or abandoned well reactivation, or by establishing allocations;
3. authorize temporary and permanent transfers of extraction allocations; and
4. establish rules to allow unused extraction allocations to be carried over from one year to another and voluntarily transferred.

However, SGMA acknowledges limitations on the regulation of pumping. Local agencies are not authorized to make a binding determination of the water rights of any person or entity (Water Code §§ 10720.S(b) and 10726.8(b)). Also, any actions to control extractions generally must be consistent with the city or county general plans (Water Code §§ 10726.4, 10726.8(f), and 10726.9).

Research into the use of similar authorities in other jurisdictions indicates that few agencies regulate pumping, and highlights related challenges. Where used, pumping regulation has been in response to significant basin problems like long-term overdraft or salt water intrusion, most commonly through the well permitting process. These agencies have struggled with well owner concerns, enforcement, and legal challenges. Others have decided against regulation due to concerns with water rights and the potential to trigger adjudication, focusing instead on financial incentives or groundwater replenishment.

GUIDING PRINCIPLES

The District's existing groundwater management framework has maintained sustainable groundwater conditions over many decades. This proven framework,' including strong collaboration with stakeholders, is the preferred approach to address future challenges. However, SGMA authotities are available as potential tools if the need arises. The process to regulate groundwater extraction, if needed, is based on these guiding District principles:

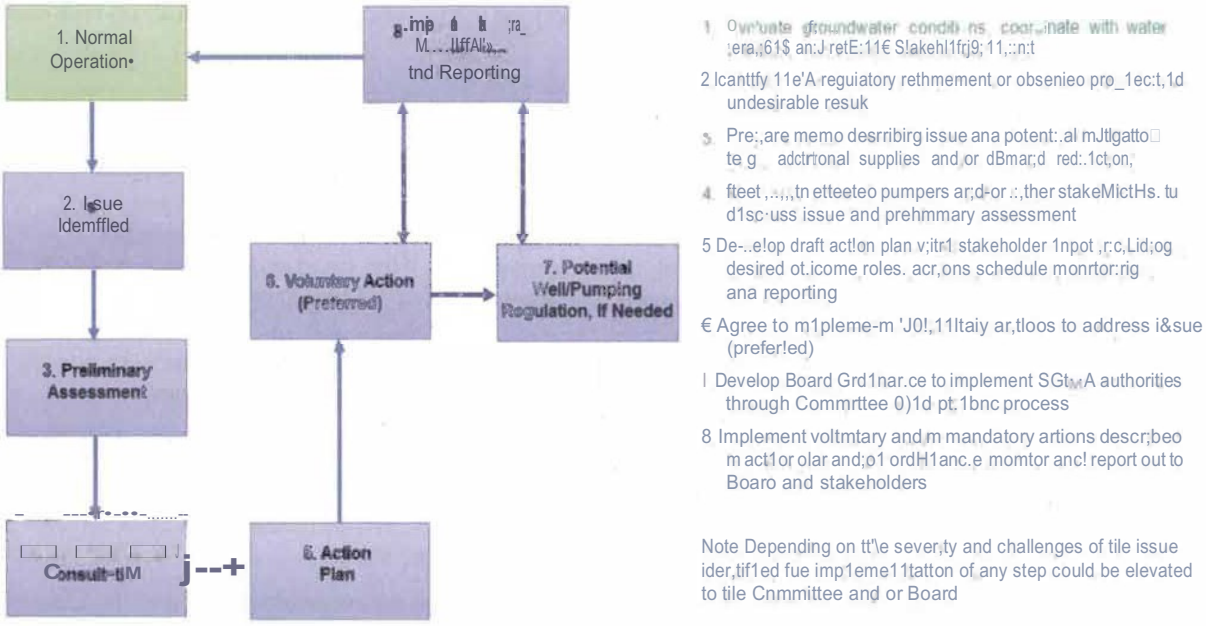
1. The District will sustainably manage local groundwater as part of our mission to provide Silicon Valley safe, clean water for a healthy life, environment, and economy.
2. The District will continue to conduct comprehensive water supply planning and invest in diverse water supplies to ensure reliability and avoid chronic shortages.
3. Through ongoing water supply operations, the District will continue to optimize the use of available water supplies while protecting groundwater storage.
4. Transparency in fulfilling the District mission remains an important driver and the District will continue to encourage input and participation from all interested stakeholders.

5. The District will continue to seek solutions that effectively and efficiently address identified water supply issues as they arise.
6. The District will work with water retailers and other stakeholders to continue to improve our understanding and management of groundwater basins and conditions, including sustainable use.
7. Strong partnerships with water retailers and other large groundwater users have been effective in avoiding undesirable results and are critical to future sustainability.
8. Collaboration with groundwater users and interested stakeholders will continue to be the preferred approach to address observed or projected undesirable results, and District regulation of pumping will only be considered if there is no viable alternative.
9. Given the uncertainty in the timing, location, and severity of potential future undesirable results, the process to regulate groundwater extraction avoids prescriptive triggers and requirements; instead, it clarifies how to respond to worsening conditions. This will maintain maximum flexibility to respond to changing conditions and avoid unnecessary or ineffective actions.

PROCESS TO REGULATE GROUNDWATER EXTRACTION, IF NEEDED

The existing groundwater management framework is expected to support continued, sustainable conditions, and pumping regulation may never be needed. The process described below and summarized in Figure 1 describes the fundamental approach to respond to worsening basin conditions, including the steps that would be taken prior to implementing SGMA authorities to regulate extraction. As mentioned above, the focus is on providing certainty as to the process, while avoiding prescriptive requirements that may not be appropriate. This process allows for moving between the various steps linearly or using feedback loops.

Figure 1. Process to Regulate Groundwater E?<traction, if Needed



Resolution No. 18-04

Step 1: Normal Operations

Comprehensive planning through the District's Urban Water Management Plan and Water Supply Master Plan ensures long-term water supply reliability (including groundwater) in accordance with level of service targets. Development of these plans includes coordination with water retailers and land use agencies, and the District encourages input from interested stakeholders. This regular, proactive planning avoids chronic shortages.

Operations planning helps meet near-term demands, protect groundwater reserves, and ensure adequate carryover supplies. Through this ongoing process, District staff develops operations scenarios based on the availability of imported and local supplies, including their optimal use and distribution. Water supply conditions are discussed with water retailers at least quarterly through Water Retailers Committee and Groundwater Subcommittee meetings, but operational or water supply issues often require more frequent communication and coordination. Current water supply information is also communicated to interested stakeholders through monthly Water Tracker updates and Groundwater Condition Reports, and the availability of groundwater level and other water supply data at www.valleywater.org.

Receiving input on groundwater management issues from interested stakeholders is an important part of normal operations. Accordingly, the District maintains a list of interested parties that includes water retailers, land use agencies, regulatory agencies, adjacent GSAs, non-governmental organizations, community groups, agricultural users, and private individuals, among others. The District notifies these interested parties of upcoming groundwater-related Board and Committee items and relevant information such as completion of the Annual _Groundwater Report. The District also provides updates to all well owners on general topics of interest through regular mailings.

The District will continue to explore ways to ensure interested stakeholders are aware of groundwater management activities and opportunities for engagement, including participation in public meetings, Board correspondence, Access Valley Water inquiries, or direct communication with staff. The District evaluates all input and inquiries to determine if additional action is needed to protect groundwater resources.

Step 2: Issue Identified

Through the ongoing assessment of groundwater conditions described above, an issue requiring further action may be identified. This could be a new regulatory requirement, such as the need to limit water supply well construction near an indirect potable reuse project, or an observed or projected undesirable result as defined in Water Code §10721 and listed above. The GWMP identifies numeric outcome measures related to groundwater conditions that indicate the need for action; observed or projected failure to meet one of the outcome measures could lead to an undesirable result. There may also be unanticipated situations that do not trigger failure of an outcome measure, but require action to protect groundwater resources.. If an issue requiring further action is identified, the District will inform potentially affected stakeholders and immediately move to the next step in the process.

Step 3: Preliminary □ssessment

Once an issue requiring further action has been identified, District staff will use available information to evaluate the issue and summarize the findings in a technical memorandum. The memorandum will describe the nature and extent of impacts, suspected cause(s), potential

effects of taking no action, and potential mitigation options. These options may include District action, such as more focused monitoring, recommended shortage response per the Water Shortage Contingency Plan, efforts to acquire supplemental supplies, or incentives for the use of treated water. Mitigation options could also include the reduction of pumping within the impacted area.

Step 4: Initial Stakeholder Consultation

After completing the prior step, District staff will meet with selected stakeholders within the affected area to discuss groundwater conditions and the preliminary assessment. This initial consultation targets those likely needing to take action to help address the issue. In most cases this is expected to include higher-volume pumpers like water retailers that more strongly influence basin conditions. Depending on the nature of the issue, other affected stakeholders may also be consulted during this stage.

The District will work with stakeholders to evaluate additional data and update the preliminary assessment as necessary. The District and affected stakeholders will identify the schedule to develop an action plan as well as related roles and responsibilities.

It should be noted that this consultation may result in quick consensus on the need to act and what needs to be done. This occurred in 2014 when the District met with staff from the San Jose Water Company and the City of Santa Clara to discuss concerns with groundwater levels approaching subsidence thresholds within their service areas. In that case, a single meeting led to quick agreement on the need to voluntarily adjust pumping. This process is intended to support similar decisive action at the staff level when possible.

Step 5: Action Plan

Based on the timeline and roles identified during the initial stakeholder consultation, District staff and/or affected stakeholders will develop a draft action plan to address the issue. This action plan will identify the desired outcome and clearly define actions needed, roles and responsibilities, implementation schedule, and how the issue will be monitored. The action plan will also explain the mechanism and timing of status reports to the Board and interested stakeholders. If the proposed mitigation involves pumping curtailment, staff recommends that affected pumpers have the first opportunity to propose an action plan to meet the desired outcome.

In the 2014 example mentioned above, District·and retailer staff collaborated quickly and effectively to reduce localized pumping and minimize the risk of subsidence. Similarly, it is expected that some issues can be effectively resolved at the staff level, with ongoing reporting to the Board Committee and stakeholders as appropriate. However, effective action plans for more severe, challenging, or widespread issues may need to be elevated to allow for more extensive input. In these cases, it may be appropriate to develop the action plan in consultation with all potentially interested stakeholders through the open forum of the Board Committee.

Step 6: Voluntary Action (Preferred Option)

Staff, affected pumpers, and other interested stakeholders will work to finalize an action plan that is likely to be effective in addressing the identified issue. This is the preferred option, which avoids resorting to the need to potentially regulate pumping under SGMA authorities. If

agreement for voluntary action is reached, all entities responsible for implementing the action plan will need to concur with the action. plan prior to implementation.

Step 7: Potential Well/Pumping Regulation, if Needed

The District and affected pumpers may not reach consensus on a voluntary action plan or implementation of a voluntary action plan may not prove effective in addressing the identified issue. In those cases, the District may need to consider implementing any of the authorities provided by SGMA under the following process:

1. Discuss groundwater conditions and the potential need for pumping regulation at the Water Conservation and Demand Management Committee and receive input from the Committee and stakeholders;
2. Implement action recommended by the Committee, which may include, but not be limited to, discussion with the full Board, further District action, or additional attempts to reach consensus on voluntary action;
3. Prepare a draft ordinance to regulate groundwater extraction in accordance with Water Code §10726.4 or otherwise exercise authorities provided by SGMA; and
4. Conduct a public hearing for Board consideration of the proposed ordinance.

Step 8: Implementation, Monitoring, and Reporting

The District, affected pumpers, and other identified stakeholders will implement the voluntary and/or mandatory actions described in the action plan and/or ordinance. District staff will monitor the status of action commitments, groundwater conditions, and performance in meeting the desired outcome. Related reporting to the Committee and/or Board as well as interested stakeholders will be in accordance with the action plan or ordinance. Based on the monitoring results and progress toward meeting the desired outcome, operations may return to normal or the voluntary/mandatory action may need to be modified. Successful execution of this step will require close tracking/monitoring and good communication.

TIME FRAME FOR IMPLEMENTATION OF THE PROCESS

There are no fixed time frames assigned to each step above due to the wide range of possibilities in terms of potential issues and related action needed, including whether it is voluntary or mandated. Staff anticipates that, for more manageable issues, effective voluntary action could be implemented within six months. More severe or widespread issues may take longer to address, even through voluntary action, as they may require consideration by a city council, board, or regulatory agency, or due to implementation lead time.

It is expected that if pumping regulation became necessary, implementation of the process listed under Step 7 would take several months to provide adequate noticing and opportunity for input. This time frame should be considered to correspond to the most extreme and severe conditions, with more time likely needed to fully engage potentially affected pumpers and interested stakeholders on this complex and controversial issue.

The severity of the issue will correspond to the response, with more resources and urgency allocated to more extreme issues. In any case, the District will work to expedite an effective response to minimize the risks to beneficial users or groundwater resources, and will remain committed to prioritizing voluntary collaboration over regulation whenever possible.



Santa Clara Valley Water District
5750 Almaden Expressway, San Jose, CA 95118-3686
Phone: (408) 265-2600 Fax: (408) 266-0271
www.valleywater.org

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